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PATTERN MATCHING MODELS

OF

VETERINARY DIAGNOSIS

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Candidate declaration

This thesis has been composed by myself and the work is my own. I have not submitted the thesis in candidature for any other degree, diploma or professional qualification.

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Abstract

In a survey of veterinarians and veterinary students pattern matching, pathophysiological reasoning and probabilities were recognised by both groups as pattern recognition strategies used in diagnosis. Veterinary students stated that they used pathophysiological reasoning most often and the veterinarians replied that they used pattern matching most frequently. Logical exclusion was used provided the data was reliable. The veterinarians indicated that they used the signs observed to be present and the signs observed to be absent during pattern recognition.

Pattern recognition analysis using case reports identified that pattern recognition was a function of a pattern matching model and not a function of a Bayes' theorem probability model with or without prevalence data. The pattern matching model most closely resembled the results of each veterinarian regardless of their experience level.

A pattern matching system for the identification of Bovine Spongiform Encephalopathy (B.S.E) was devised. This system contained four pattern matching models.The system used prototype descriptions of the differential diagnoses based upon the point prevalence frequencies of the signs within diseases. The most accurate model for the recognition of the prototype disease descriptions used the signs observed to be present and absent with logical exclusion.

The sensitivities of the B.S.E. pattern matching system and 25 final year veterinary students were tested with 50 confirmed B.S.E case reports. The model with the highest sensitivity used the signs observed to be present and logical exclusion. Three of the models were significantly better than the veterinary students at diagnosing B.S.E in patients with the disease. The model which allowed for the greatest amount of uncertainty regarding the input data had the lowest sensitivity.

A hypothetico-deductive pattern matching model was devised using sign point prevalence frequencies. This hypothetico-deductive pattern matching model of diagnosis was compared to 6 veterinarians. The performance of the model was equivalent to or better than the veterinarians.

DEDICATION

In memory of my father

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Chapter 1

INTRODUCTION

"Statistical methods can only be applied to populations of thousands. The individual either has a rare disease or doesn't have it; the relative incidence of two diseases is completely irrelevant to the problem of making a diagnosis" (DeGowen, 1969).

Medicine..'' A science of uncertainty and the art of probability''(Sir William Osler cited in Ledley and Lusted, 1959).

Diagnosis of disease is the determination of disease or diseases producing the clinical abnormalities in the patient (Dorland, 1981). It is an expression of the opinion about the nature of the disease in the animal (Hall, 1976). This function, with regard to animals, is unique to the veterinarian and is clearly defined in the Veterinary Surgeons Act 1966 (The Royal College of Veterinary Surgeons, 1993). It is an important function which enables treatment, control, prognosis and the welfare of animals to be optimised.

The process of diagnosis is poorly understood and this is reflected in the intuitive manner in which it is taught. An accurate and efficient descriptive algorithm of veterinary diagnosis would be useful for:

1. the development of credible veterinary decision support systems,

2. improving diagnostic proficiency,

3. the pedagogic teaching and computer aided learning of veterinary diagnosis, and

4. defining the clinical data recording and reporting requirements for the future.

The hypothetico-deductive method of diagnosis is the most commonly used method of diagnosis in veterinary medicine and requires the optimisation of three important diagnostic heuristics:

1. the recall of possible diagnoses,

2. the ranking of the competing hypotheses and

3. the identification of the attribute with the greatest differentiating value relative to the competing hypotheses.

The recall of possible diagnoses and the ranking of competing hypotheses use a crucial function called pattern recognition. Pattern matching and Bayesian probabilities are two methods of pattern recognition which may be used.

This study investigated the pattern recognition methods used by veterinarians and veterinary students. A survey was conducted and an analysis performed to identify the methods used. Pattern matching and Bayesian probabilities were used in the analysis. A pattern matching system for the differential diagnosis of Bovine Spongiform Encephalopathy (B.S.E) was evaluated and compared to final year veterinary students. The performance of a hypothetico-deductive pattern matching system was compared to a group of veterinarians. The heuristics of diagnosis were examined in a pilot study using numerical models of disease.

The objectives of this study were:

1. To identify the pattern recognition methods used by veterinarians.

2. to test the hypothesis that pattern recognition used by veterinarians is a function of pattern matching and not a function of the Bayes' theorem probability;

3. to evaluate the recall and ranking efficiency of production animal clinical veterinarians and compare their performance to a pattern matching model in the domain of cattle diseases;

4. To evaluate a pattern matching model for the differential diagnosis of Bovine Spongiform Encephalopathy.

5. To compare the performance of a hypothetico-deductive pattern matching model and production animal veterinarians.

This introduction describes the process and purpose of diagnosis. Hypothetico-deductive reasoning is considered as an algorithm of diagnosis. Pattern recognition by Bayesian probabilities and pattern matching are critically reviewed. A review of automated medical decision support systems is given. Data structures of diseases which can support pattern matching are described.

1.1 Diagnosis

The three most important steps in the treatment of any patient are diagnosis, diagnosis and diagnosis, the importance of making an accurate diagnosis cannot be over emphasised (Osborne, 1975).

Diagnosis is a task of classification. The usual goal of the veterinarian is the placement of the cluster of problems of a patient or group of patients into the appropriate disease category (Martin and Bonnett, 1987; Blood and Radostits, 1989; White, 1988a). This involves sorting out the most likely hypothesis or hypotheses from what is often a wide range of possibilities (Shortliffe *et al*, 1984).

Nominal data is data that can be placed into discrete categories which have no inherent order such as clinical signs e.g. jaundice or nystagmus (Smith, 1991). A disease may be defined as '' The sum of the abnormal phenomena displayed by a group of living organisms in association with a common characteristic or set of characteristics by which they differ from the norm of their species in such a way as to place them at a biological or economic disadvantage'' (Campbell *et al*, 1979). Economic has been added by White (1988a) for veterinary medicine. This study will consider the diagnosis of disease from nominal sign data and disease risk factors.

1.2 Clinical reasoning

Clinical reasoning is fundamental to the practice of medicine and involves the collection and interpretation of data; the ranking of priorities and the development and revision of hypotheses (Coggan *et al*, 1985).

It is frequently implied that there is a right and a wrong way to make a diagnosis. Veterinary curricula tend to focus on methods and disease mechanisms. The methods include, the correct way to perform a physical examination, write a medical record or choose a diagnostic test to perform. Disease mechanisms in the individual are taught through the study of anatomy, physiology, microbiology and other basic sciences. Veterinarians are taught little about the mental process that occurs while making a medical diagnosis (Smith, 1991). This fosters the belief that the correct diagnosis depends entirely on learning the methods and the detailed processes of diseases in the individual (Smith, 1991; Morley, 1991; Gorry, 1973).

Diagnosis is made more difficult by teaching in a disease orientated manner rather than a clinical sign approach. The information must then be used in reverse order in the process of diagnostic reasoning (White, 1984). It is likely that most clinical diagnostic reasoning is approached from within a hypothesis perspective. In this method the clinician determines the most likely diagnosis by assessing how well the case fits a prototypical case for the disease under consideration (Wolf *et al*, 1985).

The underlying assumption that there is a well defined monolithic diagnostic process is almost certainly simplistic and fundamentally misleading (Barnett, 1982; Coggan *et al*, 1985). Current emphasis on descriptive studies suggest there is no generally accepted theoretical model yet available, nor a clear consensus on the method of clinical reasoning used (Coggan *et al*, 1985).

Pattern recognition, rule based algorithms, the exhaustive approach (complete database), arborialisation (algorithm method), the key abnormality method and hypothetico-deductive reasoning are all diagnostic methods that have been suggested in veterinary medicine (Martin and Bonnett, 1987; Blood and Radostits, 1989). Cutler (1979) lists 19 techniques for problem solving in human medicine.

1.3 Hypothetico-deductive reasoning

Complete histories and physical examinations in veterinary medicine are myths (Pollock and Fredricks, 1988) and hypothetico-deductive reasoning is probably the most frequently used method in veterinary science (Pollock, 1985a; Blood and Brightling 1988) and human medicine (Kassirer *et al*, 1982; Elstein *et al*, 1978; Eddy and Clanton, 1982; Sacket *et al*, 1991).

Medical students generate hypotheses early in their clinical examinations without training and prompting

(Elstein *et al*, 1978). Hypothetico-deductive reasoning is an implicit heuristic and it is usually transmitted by mimicking the expert at work. Apprenticeship improves clinical judgement. Students would benefit from pedagogic techniques designed to teach the problem solving methods used by experts in clinical reasoning, but first they need to be elucidated (Kassirer *et al*, 1982).

Differential diagnosis is the process of considering the possible causes of the patients complaint before making a diagnosis (Sox *et al*, 1988).

Hypothetico-deductive reasoning is a highly flexible approach to problem solving (Shortliffe, 1984). It utilises alternately, a data driven forward chaining (deduction or *a posteri*) approach and then a backward chaining (induction or *a priori*) method. The initial hypotheses are derived from the primary data entry, and subsequent data collection is guided by the leading hypothesis and the competing hypotheses under consideration. The leading hypothesis may change depending on the new data entry evoked which will dictate the next finding to investigate. The competing hypotheses are compared one by one to the leading hypotheses (Eddy and Clanton, 1982). This process continues recursively until a critical level of confidence has been reached (Elstein *et al*, 1978; Eddy and Clanton, 1982). The final step is usually the validation of the diagnosis. This process is shown in fig 1.01.

Hypothesis generation or recall is critical, the correct diagnosis cannot be made if it is not considered. (Elstein *et al*, 1978).

Aggregation of the elemental findings from the initial data may simplify the diagnostic process (Eddy and Clanton, 1982). The generation of the initial list of possible diagnoses is sometimes selected by using an element of the initial data as a pivot or key sign. The list includes all

```
             Initial observations
                        |
 Rare                   v
-->-->-->--> Recall of differential
|                diagnoses
|                       |
|Frequent               v
|-->->-->--> Ranking of the
|          differential diagnoses
|                       |
|                       v
-<--<--<--< Collection of differentiating data
                        |
                        v
                 Diagnosis
```

Fig 1.01 Hypothetico-deductive reasoning the diseases that contain the pivot. The pivot is usually a sign which is clearly recognised as a disease abnormality (Blood and Brightling, 1988).

The refinement process includes discriminating between close competitors, pursuing highly likely but unproven possibilities, ruling out less likely competitors and occasionally invoking new hypotheses as additional unexpected findings are obtained. Cues are selected to confirm or rule out a diagnosis (Shortliffe, 1984). This process includes the competing-hypothesis heuristic which is the consideration of each piece of information with respect to all hypotheses under consideration before a diagnostic judgement is made (Elstein *et al*, 1978). Findings are not sought if they are not related to one of the diagnostic categories under consideration (Barrows and Tamblyn, 1980).

This method produces a very specific and highly efficient search for information. It is a method which induces a high level of motivation in the user in comparison to a complete clinical examination. The sign being investigated has a higher probability of being present when compared to a complete clinical examination. Complete clinical examinations have a higher proportion of negative findings which can induce a reduction in abnormality recognition due to user fatigue.

The number of hypotheses under consideration at anyone time is usually four or five with a maximum of six or seven (Elstein *et al*, 1978 ; Pollock, 1985a; Blois, 1980).

Research on problem solving has demonstrated that human beings consistently make systematic heuristic errors. These include, the collection of cues which are none contributory and which do not lead to the confirmation or testing of a hypothesis, failure to correctly retrieve the correct hypotheses from memory, data collection about inappropriate hypotheses and incorrect pattern recognition or cue interpretation. The most prevalent cause of incorrect diagnosis is a failure to generate and consider the relevant diagnostic hypothesis (Dowie and Elstein, 1988; Detmer, 1978; Elstein *et al*, 1978). A study of diagnostic errors showed the errors were mainly failures of obtaining information or appreciating the importance of information available (Gruver and Freis, 1956).

New data is generally only considered in relation to the hypothesis that is being tested and not in relation to alternative hypotheses (Fischoff and Beyth-Marom, 1983; Morely, 1991). Information that does not fit the differential diagnoses under consideration may be ignored in preference to generating alternate hypotheses (Fessler, 1984b). Students tend to seek confirmatory information rather than rule out information which reduces their diagnostic efficiency further (Kern and Doherty, 1982). The implementation of diagnostic reasoning is imperfect.

1.4 Pattern recognition

Pattern recognition identifies an object by classification into a category by some means of measured properties or features (Smith, 1990; Tou and Gonzales, 1974; Kulikowski, 1970). It defines the mathematical relationship between the measurable features and classification of objects (Duda and Hart, 1973).

Three pattern recognition methods are used in diagnosis probabilistic, pattern matching and pathophysiological (Wulff, 1976). It has been found that the pathophysiological method is used infrequently in hypothesis generation by clinicians (Elstein *et al*, 1978; Schmidt *et al*, 1990), although, it may be important in increasing certainty by understanding the abnormalities at different levels of abstraction (Patil *et al*, 1981).

Hypothetico-deductive reasoning requires a method of pattern recognition to enable a list of disease attributes to be transformed into a ranked list of differential diagnoses. Pattern matching and statistical probabilities using Bayes' theorem are two methods of pattern recognition which may be used.

1.4.1 Statistical Probabilities

Bayes' theorem has been used to calculate the probability that a clinical finding was caused by a particular disease (Lusted, 1968). If all the required data is available the formula may produce an accurate probability. The data requirements are the frequency of occurrence of the sign or set of signs within the diseases under consideration and the prevalence of those diseases. The theorem can also be defined in terms of sensitivity, specificity and prevalence.

The most severe limitation when using Bayes' theorem as a method of pattern matching may be the human inability to perform the mathematical computations required. The teaching methods currently used also favour a pattern matching approach to diagnosis.

Veterinarians sometimes misunderstand the meaning of probabilities. The most probable diagnosis on the basis of one symptom may not be the most likely when all the data is considered. The most likely diagnosis may not be the correct diagnosis (Wolf *et al*, 1985). Veterinarians may also believe they are using probabilities when they are using confidence weightings (Gorry, 1973).

Prevalence data may not always be available for all the diseases under consideration. The prevalence of a disease represents an average risk factor of the disease occurring within a given area at the time of the disease outbreak. This may not be relevant to an individual within the area that has local determinants operating. The risk factors need to be re-defined in terms of the probability of disease given the determinants operating on the individual at the time of the disease outbreak. This would have to be defined for every disease under consideration and would be difficult. Prevalence is therefore an approximation of the risk factors operating.

In most cases conditional independence of the signs is assumed and this can be an inaccurate assumption (Smith *et al*, 1986; Eddy and Clanton, 1982). Pathophysiologically signs can be related and can occur more frequently together than conditional independence would suggest. Conditional independence of signs is assumed because the sensitivities of the sets of clinical signs within diseases are largely undetermined or not reported.

The sample population which is used for the specificity data must be representative of the potential population of patients (Martin and Bonnett, 1987; Smith *et al*, 1986). Fleiss *et al* (1972, according Rogers *et al*, 1979) demonstrated a decrease in accuracy when the data was applied to a new population using a Bayesian model (Rogers *et al*, 1979).

A gold standard means of identifying the diseased animal is required for measurements of sensitivity and specificity, this is not always possible (Sackett *et al*, 1991).

Humans find it difficult to remember and manipulate large amount of numerical information and much of the data is not easily memorised. The lack of available data make it exceedingly unlikely that the reasoning process used by physicians to perform complicated diagnoses resemble classical Bayes' theorem (Eddy and Clanton, 1982; Tversky and Kahneman, 1974 ; Feinstein, 1977)

Clinicians recognise levels of belief or certainty but they do not routinely quantify or use these certainty concepts in any formal statistical manner (Gorry, 1973). Probability theory has been shown not to account for human decision making behaviour (Feinstein, 1967; Kern and Doherty, 1982; Elstein *et al*, 1978). Studies in human medicine have demonstrated a lack of ability to apply the theorem objectively even in the simplest applications (Fischoff and Beyth-Marom, 1983; Wolf *et al*, 1985; Christian-Szalanski and Bushyhead, 1981; Leaper *et al*,1972)

Bayes' theorem may offer a theory by which people should evaluate hypotheses but it may be beyond their capabilities (Fischoff and Beyth-Marom, 1983) and it is contrary to their theoretical training. The lack of capability with regard to information manipulation and computation could be compensated by the use of computerised decision support systems but these may still lack credibility if their methodology is foreign to the user.

1.4.2 Pattern matching

Pattern matching is the comparison of the input data to a stored template or standard that determines the closeness of fit (Owen, 1984). Pattern matching procedures using diseases compare the signs of a patient with the sign profile of each disease in the database (Rogers *et al*, 1979). The database in the case of a clinician is usually profiles of similar previous cases stored in the memory (Blood and Radostits, 1989). The template held in the memory is probably a prototype or an ideal type profile. The pattern matching process may be restricted to common diseases in the initial hypothesis generation. If matching proceeds badly after obtaining additional data pattern matching may be extended to diseases which are less common.

Pattern matching is a simple method requiring a quantitative profile of the disease signs. The method can be used independently of the disease prevalence to identify the disease with the best fit profile or used with broad categories of prevalence such as common or rare to identify the disease with the best fit profile within these categories.

Strong links exist in memory between salient cues and certain hypotheses triggered by these cues (Barrows and Bennet, 1972). The most salient hypotheses are identified as the most probable. Are they salient because they are the most probable or are they identified as being probable because they are experienced as vivid and salient? (Elstein and Bordage, 1988). The work of Tversky and Kahneman (1973, 1974) suggests the latter. The veterinarian may think he or she is using probabilities but may be confusing probabilities with the vividness of a pattern matching process.

Medical education is presented in a disease orientated manner and it is likely that clinical diagnostic reasoning is approached from within a hypothesis perspective. The clinician determines the most likely diagnosis by how well the case fits a prototypical case for the disease under consideration. Clinicians who make diagnostic judgements solely based on the clusters of clinical findings associated with a particular disease most likely would not make comparisons consistent with the Bayes' theorem probabilities (Wolf *et al*, 1985). Pattern matching is the most likely alternative.

The differences between experts and less adept problem solvers can be explained by the experiences tucked away in the long term memory, rather than variations of problem solving heuristics. The difference between weak and expert problem solvers in medicine are more to be found in the repertory of their experiences, organised in their long term memory than in differences in the planning and problem solving heuristics employed. The interpretation of cues in terms of hypothesis generation is not well understood but it is probably list matching (Elstein *et al*, 1978).

Support for the idea that expertise is critically dependent on knowledge is derived from studies on chess masters. Such experts do not recall a randomly arranged chess board any better than novices do but when confronted with a position that could occur in a real game they typically reproduce the board exactly (de Groote, 1965; Chase and Simon, 1973). De Groote (1965), presented chess players with mid-game positions and found that chess grand masters were not distinguished from weaker players in planning further a head or more deeply. The only difference that he could identify were in memory and perception.

In internal medicine, problem solving skills diminish notably when the diagnosticians were outside their speciality areas. Physicians and students vary considerably in their diagnostic effectiveness according to the nature of the problem at hand (Elstein *et al* , 1978). The process of acquiring expertise in chess appears to consist of learning configurations and their significance (Chase and Simon, 1973). Perhaps clinicians must also learn configurations of findings in-order to perform as experts (Kassirer *et al*, 1982). The general problem solving method may include pattern matching of disease profiles and associated algorithms.

1.5 A review of automated medical diagnostic decision support systems

1.5.1 Introduction

This section describes the historical development of automated decision support systems in medicine and veterinary medicine. The structures that support knowledge based systems are discussed and pattern recognition methods are described. Uncertainty in diagnostic reasoning is considered in relation to automated systems.

The term, " Pattern recognition", will be used to describe the identification of patterns in pattern matching, statistical probabilities, semantic relationships, Bayesian belief systems and neural network connections,

Humans are accomplished at pattern recognition (James, 1988). It has been stated that 99 % of human intelligence is pattern recognition and 1 % reasoning (Forsyth, 1989). The pattern recognition process is often sub-conscious and is not explicit to the subject (Ledley and Lusted, 1959). Pattern recognition techniques are an important component in medical decision support systems and are used for the classification of a patient into a diagnostic or treatment group (Shalkoff, 1992).

Diagnoses vary widely in their accuracy (Garland, 1959; Rosenblatt, M.B. *et al*, 1973; Prutting, 1967). Medical students usually learn about decision making in an unstructured way largely through observation and by emulating the thought processes they perceive to be used by their clinical mentors (Kassirer and Gorry, 1978).

Motivations to understand and to automate the process of clinical decision making have included a desire to improve the: accuracy of clinical diagnosis, reliability of clinical decisions, understanding of the structure of medical knowledge and understanding of clinical decision making (Wardle and Wardle, 1978).

This chronology of automated decision making in medicine has been adapted from Kulikowski (1980).

1940s	Statistical hypothesis testing methods in radiology (Yerusholmy, 1947).
1954	Logical scheme for matching symptoms to diagnoses slide rule (Nash, 1954), Hollerith cards for sorting and matching.
1958	Statistical and logical techniques combined (Lipkin and Hardy, 1958).
1960	Bayesian and discriminant methods (Ledley and Lusted, 1959).
1969	Statistical and pattern matching models (Kulikowski, 1970; Patrick, 1977).
1970s	Information processing models for diagnosis (Wortman, 1972).
1970s	knowledge-based artificial intelligence systems. (Gorry, 1973)
1980s	Neural networks (Bounds *et al*, 1990),fuzzy logic (Adlassnig, 1986) and Dempster-Schafer methods (Lucas and van de Gaag, 1991).
1990s	Integration of statistical and artificial intelligence methods, Bayesian belief systems (Todd and Stamper, 1994).

Pattern recognition methods in automated systems have included logic (set theory, Venn diagrams and Boolean algebra), pattern matching, probabilities with and without conditional independence (Bayes' theorem), knowledge based systems (production rules, syntactical networks) with or without hierarchical and aggregational structures, Bayesian belief systems and neural networks. The pattern recognition methods within these systems are representations of the pathophysiological (functional), pattern matching and probability methods of pattern recognition.

Uncertainty has been represented by probabilities, fuzzy logic theory, Dempster-Schafer theory, weightings and switches on logical exclusion.

1.5.2 Logic and probabilistic reasoning

Ledley and Lusted (1959) stated that logic (as embodied in set theory and boolean algebra) and probabilistic reasoning (as embodied in Bayes' theorem) were essential components of medical reasoning. During the early development of medical diagnostic decision support systems separate development of logical deductive systems and probability systems occurred for philosophical and practical reasons (Miller, 1994; Szolovits and Pauker, 1978).

(i) Logic

Several text books of differential diagnosis for veterinary medicine have been written (Gibbons, 1966; Blood *et al*, 1990; Hungerford, 1975; Andrews, 1990 ; Barlow, 1982).

A book can provide the causes of single signs but it cannot deal with combinations of signs. Unfortunately it is by considering the causes of combinations of signs that the most rapid narrowing down of the range of possibilities is secured. (Nash, 1960 ; Morely, 1991; Pollock, 1985b).

In 1954, Nash invented a mechanical device resembling a slide rule which enables a human clinician to match various combinations of 82 signs and symptoms in order to choose the most likely diagnosis from 337 diseases (Nash, 1954).

Edge punched and feature cards which have the same function have been described (Thrusfield, 1986; Lipkin and Hardy, 1958).

An algorithm in the form of a branching decision node scheme for the differential diagnosis of convulsions in calves (Blood, 1985) has demonstrated the inflexibility and complexity of such a method. Simple, short diagnostic algorithms have been used to good effect in a non-expert environment (Essex, 1977).

Logical systems based on discriminating between exclusive alternatives have used production rules (Bleich, 1972) and list matching (White, 1984, Pollock, 1988).

Medical decision making embodies uncertainty, functional reasoning and quantitative information which these systems cannot easily accommodate.

(ii) Probabilistic reasoning

Meehl (1954) using mathematical and statistical procedures found that the diagnostic accuracy was greater than human clinical judgement in 23 out of 35 medical studies with the remaining 12 studies being approximately equivalent.

Warner *et al* (1961) demonstrated that Bayes' theorem could be used to solve diagnostic problems. Bayes' theorem assuming condition independence has been used extensively in medical diagnostic decision support systems. Examples are, a system for the diagnosis of abdominal pain in humans (de Dombal *et al*, 1972) and Bovid (Blood *et al*, 1989) a veterinary, cattle disease, decision support system. Bovid uses Bayes' theorem to compute the probability of the disease occurring given a set of clinical signs. Conditional independence of the signs is assumed. The point prevalence frequencies of the disease signs within the database are compiled by an expert panel of veterinarians and are not based upon case reports. No published reports regarding the diagnostic efficiency of this system could be found following a literature search.

Systems using conditional dependency have been developed (Russek *et al*, 1983).

(iii) Statistical pattern recognition and pattern matching

Pattern recognition techniques define the mathematical relationship between measurable features and classification of objects (Duda and Hart, 1973). In order to find the diagnostic pattern or discriminant function the method requires a training set of objects for which the correct classification is already known as well as reliable values for the measured features. Parametric and non-parametric techniques can be used.

Three common training criteria for the discriminant function are least squared error, cluster criterion and Bayes' criterion. There are numerous variations in the mathematical techniques used to extract characteristic measurements (the features) and to find and refine the pattern classifier during the training process. Details of clustering and discriminant analysis are given by Miller *et al* (1981) and Begg (1986).

The knowledge base used by nonparametric methods such as the nearest neighbour comparisons is composed of profiles of correctly diagnosed cases. The most common of the matching procedures involves the assignment of a weight to each symptom for each disease. The symptoms of the patient are then summed according to their weight for each disease. The disease which produces the largest ratio of the patients weighted sum of symptoms to the weighed sum of all the characteristics of that disease is considered the correct diagnosis. This procedure is called weighted summation.

List matching compares a patients disease profile with the stored profiles of diseases in the database.

Provides (Pollock, 1984) and Consultant (White, 1988b) are two veterinary examples of list matching diagnostic algorithms. They are computer based decision support systems.

In Consultant the input is the clinical signs or clinical sign for which a list of differential diagnoses are required. The output is all the diseases which have the sign or signs. This is a simple list matching procedure.

Provides generates a differential diagnosis list by comparing the patients attributes to a profile of expected findings for each disease. The system creates a list of differential diagnoses by comparing patient characteristics with patterns of discriminatory findings ("propensities") for each disease. The profile consists of findings that are strongly associated with the disease and which at the same time tend to differentiate it from other potential causes of the patients problems. Diseases are then ranked according to the ratio of findings exhibited by the patient to those expected for the disease (Pollock and Fredricks, 1988).

Provides does not attempt to arrive at a single diagnosis but rather is intended to provide a list of reasonable possibilities for the clinician to consider. No disease is excluded just because it cannot account for all of the patients signs (Pollock, 1984).

The method used by Provides gives all the findings equal weighting. Pollock (1985b) states, " Although assigning different values to different findings would theoretically improve the systems diagnostic acumen, there is no good or generally accepted method of assigning appropriate probabilities to the various combinations of findings and diseases". This study will challenge this statement by using point prevalence frequencies for the weighted summation.

1.5.3 Symbolic reasoning

An alternative to categorical and probabilistic reasoning is symbolic reasoning (Gorry, 1973). Symbolic reasoning systems are also known as knowledge based systems.

The significant information in a pattern may not be in the presence or absence of a feature, or the numerical values of a set of features but may be in the interrelationships or interconnections of the features. This structural information may facilitate structural description and classification. Symbolic systems can represent and identify functional relationships.

Hierarchies can be constructed using syntactical structures. These structures can be used to represent the pathophysiological and anatomical relationships in a disease process. Using these networks complex functional patterns can be simplified using aggregation or hierarchical decomposition thus simplifying the diagnostic process (Chandrasekaran, 1986)

Systems in this category include PIP (Pauker *et al*, 1976), INTERNIST-1 (Miller *et al*, 1982) and MYCIN (Shortliffe, 1984).

(i) Knowledge representation in syntactical systems

Production rules, frames and semantic networks can be used to provide the knowledge structure for syntactical systems.

Production rules can be used independently but such a system requires a large number of facts and rules. More commonly they are used in semantic networks or combined with frames.

A semantic net consists of nodes (nouns) linked by arcs (verbs and adjectives). This structure explicitly describes the relationships between nodes. Diarrhoea and dehydration could be nodes linked by an arc, "causes", producing; Diarrhoea "causes" diarrhoea. Complex relationships can be represented by cross linking attributes.

Frames and scripts can be considered as extensions to semantic nets. Nodes are replaced by more structured groupings of information called frames. Frames can be organised in a hierarchal manner and can represent class and subclass dependencies.

Examples of knowledge based structures used in medical decision support systems have been described by Feischi, (1990):

Production rules: MYCIN (Shotliffe,1976), VM (Fagan *et al*, 1980), Guidon (Rodolitz and Clancey 1989).
Semantic networks: CASNET (Kulikowski and Weiss ,1982), EXPERT (Kulikowski and Weiss, 1982), ABEL (Patil *et al*, 1982).
Frames: INTERNIST (Miller *et al*, 1982), CENTAUR (Aikins, 1980 cited by Fieschi,1990).
Combination of frames and production rules: PIP (Pauker *et al*, 1976).

(ii) Probabilistic versus symbolic reasoning

Statistical or probabilistic approaches are performance orientated in contrast to AI approaches which are orientated towards explanation and understanding (Szolovits and Pauker, 1978).

Statistical methods operate as a black box and a score is the sole basis for ranking (Kulikowski, 1970). The application of AI sought to remedy the black box situation by introducing a structure of knowledge of medicine familiar to the clinician accompanied by explanations of the reasoning used.

The philosophy of developing statistical systems differs fundamentally from the knowledge based systems. Statistical systems take data from patients as their starting point; knowledge based systems are based upon expert opinions. Studies collecting data for statistical systems identify new facts and sometimes demonstrate that expert opinions contain errors. Knowledge based systems are more likely to perpetuate the opinions of the expert consultants, right or wrong. However, statistical systems are reliant upon substantial and accurate data which are not always easily available which may limit their application in large domains (Rector, 1984).

(iii) Meta-rules and hierarchical structures

Knowledge can be arranged in a hierarchy in syntactical networks. In hierarchical structures meta-rules can be used to control the appropriate application of production rules. In NEOMYCIN and GUIDON (Rodolitz and Clancey, 1989) control is determined explicitly by meta-rules.

(iv) Reasoning methods in knowledge based systems

Representation of inference criteria can be in the form of rules. The rules can be in the form of, definitional rules, e.g if the patient is male he is not pregnant, cause to effect rules, e.g if the cow has severe milk fever she will be recumbent, effect to cause rules e.g. if the cow is hypocalcaemic the diagnosis is milk fever and association rules, e.g. if the scouring calves are at grass consider parasitic gastroenteritis (Shortliffe, 1984).

Reasoning can be goal directed ,data driven or hypothesis directed (Shortliffe, 1984).

A goal driven system is MYCIN (Shortliffe, 1976), one of its goals is to identify the infectious agent in the patient.

A data driven system is Ventilator Manager (VM) (Fagan *et al*, 1980) which is used to wean patients off ventilator machines following open heart surgery. Inputs are the patients physiological parameters which evoke rules for further management. Temporal changes are monitored which also evoke rules and advice. ONCOCIN (Shortliffe, 1986) a decision support system for cancer chemotherapy protocols is another data driven system.

Hypothesis directed reasoning is used in Internist-1 (Miller *et al*, 1982) and uses forward chaining and backward chaining (inductive and deductive reasoning). The clinician enters a list of pertinent patient attributes e.g. signs which are absent or present. This initial data set evokes a set of disease hypotheses that are partitioned into subsets of competitors using an algorithm. The set of the most highly supported hypotheses then become the focus of attention and the program enters a questioning mode in which manifestations are requested in accordance with their ability to help sort out the best hypothesis among the competing set. Scores are recalculated as the clinician enters the data and the focus may shift as hypotheses are rejected or confirmed by the new information.

Inheritance hierarchies form part of the symbolic knowledge representation in Internist-1.

(v) Characteristic elements of AI systems.

In contrast to pattern matching systems and statistical approaches there is a deliberate separation of the knowledge base and the reasoning evaluation and control components. The knowledge base is often clearly divided into a descriptive component of data structures and a normative component of prescriptive reasoning rules.

Methods of AI were first introduced into CASNET, MYCIN,INTERNIST and PIP systems. They use highly structured representations of medical knowledge.

In CASNET,INTERNIST and PIP the reasoning process is centred around an explicit structural descriptive component. The causal nets and hierarchical taxonomies can be viewed as special cases of semantic networks. The normative or reasoning knowledge in these systems is expressed as decision rules attached to the nodes of the semantic net. In contrast MYCIN centres its knowledge around the normative component: the production rules.

(vi) Artificial Intelligence systems

Below are 7 knowledged based systems which illustrate the structures, reasoning and methods for quantifying uncertainty.

i. CASNET (Kulikowski and Weiss 1982)

CASNETS knowledge consists of a network of causal connections between observations and physiological states and rules which state preferences for treatment based on patterns of findings of glaucoma. CASNET expresses knowledge at 3 levels: diagnosis, pathophysiological states and observations, a loss of visual acuity (Observation) might be caused by swelling of the covering of the eye (pathophysiological state) as a manifestation of angle closure glaucoma (diagnosis).

A causal association network representing the pathogenesis of a disease in terms of which the patients findings are interpreted. The causal relations with associated degrees of strength express not only mechanisms of disease but their modifications under various treatment regimes. Different patterns over the causal network are associated with the various elements in a classification scheme of diagnostic hypotheses that can include degrees of severity and progression of disease. The reasoning control strategy of Casnet can be characterised as mainly event driven. The incoming data triggers inference rules that assign weights to the pathophysiological states. The choice of the next question is hypothesis driven. A final evaluation is deterministic in nature depending on the weighting achieved in the various nodes.

ii MYCIN (Shortliffe, 1976)

MYCIN is a backward chaining, goal driven system for the diagnosis of patients with severe infections. It is goal driven in a backward chaining mode from goal to subgoal. Emphasis is placed on explanation of the reasoning process.

The knowledge representation is in the form of a system of production rules with associated uncertainty weights. Rules are of the form: if premise assertions are true then consequent assertions are true with confidence weighting X. It uses goal-directed backward chaining rules. The reasoning evaluation mechanism uses a fuzzy logic function for combining the effect of uncertain assertions within a rule and a heuristic cumulative function to add the confidence weights from rules with different sources of evidence in their premises. Separate measures of belief and disbelief are used in updating hypothesis weights. It is modular and explicit with regard to the reasoning function.

iii INTERNIST-1 (Miller *et al,* 1982)

INTERNIST-1 has a knowledge base in the form of a hierarchy of diseases, from the general (e.g liver disease) to the specific (e.g. hepatocellular infection) with typical findings linked to the most specific form of each disease group. Other links include disease to disease causal connections. Subjectively estimated weights are applied to the links. The initial data evokes a set of related disease hypotheses which are ranked further evidence is then gathered related to the hypotheses which are highly ranked.

Three variables are associated with each manifestation (e.g. sign) in the INTERNIST disease profile:

1. An evoking strength
Given a patient with this finding how strongly should I consider this diagnosis to be the explanation.

2. A frequency
The frequency is an estimate of how often the patients with the disease have the finding.

3. Import
The import is the global importance of the manifestation, which is the extent one is impelled to explain its presence in the patient.

The diagnoses are organised into a hierarchical taxonomy or nosology. At each stage INTERNIST attempts to find a diagnoses or set of diagnoses which explain all the findings so far discovered. Alternative partial explanations are presented.

Three different strategies are used in the search:

1. If only one hypothesis is under consideration the system seeks evidence to confirm it.
2. When there are 2 leading candidates the system seeks evidence which discriminates between them.
3. With large numbers of hypotheses the system seeks negative evidence to rule out as many as possible.

Diagnosis by exclusion is used as a strategy. It will accept the remaining hypothesis irrespective of the amount of supporting evidence.

iv CARDIAG-2 (Adlassnig, 1986)

CADIAG-2 is a medical expert system for decision support of diagnosis (Adlassnig, 1986). Representation of medical knowledge is in the form of relationships between: symptom-disease, symptom combination-disease, symptom-symptom, disease-disease. There relationships are characterised by 2 parameters: frequency of occurrence (always=1, never=0) and the frequency with which X occurs when Y is present. In addition there is a strength of confirmation value (always=1, never=0) which represents the degree to which the presence of X implies the presence of Y. The relationships between medical entities are given in the form of relationship rules. Fuzzy logic inference accepts the fuzzy descriptions of the patients symptoms and infers fuzzy descriptions of the patients diseases by means of fuzzy relationships.

v PIP (Pauker *et al*, 1976).

A frame is the structure used to describe disease categories. The frame contains logical, semantic and associated inference rules. Hypotheses are tested by categorical matching findings or by probabilities. The system uses pattern matching using observed to expected findings ratio and the number of findings explained by the hypothesis to the total number observed.

vi Fluidex (Furukawa *et al*,1987)

Fluidex is a decision support system to diagnose the state of fluid balance and to recommend treatments.

Fluidex has a hierarchical organisation and uses production rules. Knowledge indicating the restriction or inhibition of the production rules area are called meta-rules.

The first level of the hierarchy uses production rules to generate hypotheses. The second level restricts the improper use of the rules, the third level treats the relationships between the hypotheses and the fourth level evaluates the overall conformity of the diagnosis.

vii Abel (Patil *et al*, 1984)

Experts may reason at several levels of detail. The highest levels may be diseases and syndromes built up from sign disease associations. At the deepest level it may include biochemical and pathophysiological causality. Abel is multilevel in its reasoning. There is a hierarchical representation of medical knowledge. The causal physiological reasoning tends to be categorical and the disease level probabilistic the hierarchical description allows a blend of categorical and probabilistic reasoning.

Each level of the description can be viewed as a semantic net describing a network of relations between diseases and findings. The system uses aggregation and abstraction. Three levels, pathophysiological, intermediate and clinical are described which have increase aggregation.

Uncertainty is divided into two types, ignorance and chance. Uncertainty due to ignorance is resolved by concluding the patient has a general type of disease e.g. some form of liver disease. A value is assigned to the general disease but no values are given to diseases within this set (Dempster-Shafer). The resolution of chance requires a statistical analysis.

viii A veterinary knowledge based system for mastitis

A knowledge based system for the diagnosis of mastitis problems at the herd level has been described (Hogeveen *et al*, 1995a, 1995b). This system is a conditional causal model with multiple layers. The first layer consists of three overview models: the general overview conditional model, the contagious overview conditional causal model, and the environmental overview conditional causal model giving a causal description of the pathways through which mastitis problems can occur. The conditional causal model for the primary udder defence and the conditional causal model for the host defense are attached to the overview models at the second layer, and the conditional model for deep primary udder defences is attached to the conditional causal model for the primary udder defense at the third layer.

(viii) Reasoning over time

Several systems have addressed the problem of reasoning over time, these include ,VM system (Fagan *et al*, 1980), EXPERT for ventilator management and CASNET (Kulikowski and Weiss ,1982). Bovid (Blood *et al*, 1989) ignores observations made at different times and combines the data using Bayes' theorem with conditional independence.

1.5.4 Bayesian belief networks and fuzzy set theory

One of the major problems for research in decision support systems for medicine is to integrate functional knowledge based and statistical techniques (Rector, 1984).

Systems based on fuzzy set theory (Zadeh,1965) and Bayesian belief networks (Herskovits and Copper, 1991) were developed to overcome the limitations of symbolic or heuristic and simple Bayesian models (Miller, 1994).

(i) Bayesian belief networks

Bayesian belief networks which are also called, probabilistic causal networks or Bayesian networks represent a merger of symbolic or artificial intelligence and Bayesian probabilities. Belief systems make dependencies explicit and use probability theory.

Bayesian belief networks provide a method for representing probabilistic dependencies and independence. Relationships between observations, intermediate states and diagnosis can be expressed on a continuum from full independence to full causal dependency (Miller, 1994).

Belief networks consist of a directed acyclic graph containing nodes whose link strengths are represented by probabilities. The determinants of the probability distribution of a node are the values of its parents, of its children and of its childrens parents in the graph (Miller, 1994). Todd and Stamper (1994) provide an example of this system.

Objective values for the link weights are not routinely recorded and the network can be very large and complex. These limitations may constrain the application of belief networks to small well documented domains.

(ii) Fuzzy set theory

Fuzzy set theory includes formal methods addressing incompleteness, inaccuracies and inconsistencies that are found in medical data and medical knowledge. Adlassnig (1986) has applied fuzzy set theory to the diagnosis of rheumatological and pancreatic disorders. SPHINX (Feischi , 1990) a medical diagnosis program, uses fuzzy logic as a means of dealing with uncertainty. Probability theory and fuzzy set theory have been combined to find the probability of a fuzzy event and produce a weight of evidence with an error function for equine colic (Cecile and Mcleish, 1991).

Systems using fuzzy set theory have representation schemes for the degree to which a given patient exhibits a set of findings, and represent confidence or certainty of a given diagnosis on a continuum from 0 to 1. By applying upper and lower bounds on patient attributes and using fuzzy measures of sensitivity and predictive value in addition to using boolean operators it is possible to derive bounded certainty values for possible disease states.

1.5.5 Neural networks

Connectionist models such as neural networks are alternatives to linear, parametric statistical methods. Neural networks are computer-based pattern recognition methods with architectural similarities to the nervous system. Nothing is stored in a single location: all knowledge is implicit in the pattern of the systems interconnections.

Individual variables of the network usually called neurones can receive inhibitory or excitatory inputs from other neurones. The networks can define relationships among input data that are not apparent using other approaches and they can use these relationships to improve accuracy. Neural nets can recognise patterns in complex data sets. They can be dynamic and temporal whose state changes with time in response to external inputs.

The connectivity of a neural network determines its structure. Patterns are identified by the output of the system. Neural network methodology has outperformed classical statistical methods where the input variables are interrelated. Clinical attributes are usually derived from multiple interrelated systems. Neural networks might be more accurate than classical methods in multivariate analysis of clinical data (Forsstrom and Dalton, 1995). The weights learned by simple one-layer networks can be identical to Bayesian probabilities (Miller, 1994; Todd and Stamper, 1994).

Development for a specific application involves the selection of the topology (number of inputs units, number of output units, number of hidden layers, number of units in each layer and the connections between units including feedback loops), selection of a training rule to adjust weights within the network, and the selection of training cases or examples to set the weights within the network (Miller, 1994).

Diagnostic systems using neural networks have been have included ; diagnosis of thyroid function (Sharpe *et al* 1993), diagnosis of multiple melanoma (Bugliosi *et al*, 1994) abdominal pain (Todd and Stamper, 1994) low back pain (Bounds *et al*, 1990) and myocardial infarction (Baxt, 1991).

Neural networks require large data sets which are not always available in medicine. Neural networks operate as black boxes. Experimenting with different networks has little impact on fundamental clinical knowledge (Forrstrom and Dalton, 1995).

(i) Symbolists versus connectionists

Symbolists insist that knowledge has to be explicit and ideally comprehensive to an outsider looking into the system. The connectionist is content to deal with black boxes .

Forsyth (1989) has suggested that connectionists representations should only be used where symbolic systems have failed and even then only as subordinate modules in an overall system whose high level reasoning is as transparent as it can be. The main concern expressed was the lack of transparency about how the neural network arrives at a conclusion.

1.5.6 Uncertainty

Medical decision making is confounded by having to make decisions under uncertainty and systems have to make allowances for the sources of uncertainty (Cohen and Gruber, 1984).

(i) Sources of uncertainty

In automated systems the entry of data supplies evidence which invokes inferences which generates beliefs.

The data entered may be inaccurate or insufficient. Rule based inference systems capture knowledge about a domain. The expert inference rules are often a summation of different experiences which may not be accurate with every instance. Beliefs derived from the rules may be incorrect or sub-optimal (Cohen and Gruber, 1984).

(ii) Dealing with uncertainty

All the AI approaches use heuristic measures for scoring the weight of confidence or credibility to a hypothesis. These are usually uncertainty values attached by human experts to the various reasoning rules in the model.

A certainty factor for a rule represents the expert's confidence in it, but it is not always clear what "confidence" means. For example, a rule in Mycin (Shortliffe and Buchanan, 1975) states that obesity implies illness may have a certainty factor of 0.8 associated with it. This number may represent the proposition that 80% of obese people get sick, that the probability is 0.8 that a sick person is obese or that the general rule that obesity causes sickness is more applicable than a rule with a certainty factor of 0.6.

Whatever the meaning, the effect of the certainty factor on a rule is to weight the belief in its conclusions: the higher the rules' certainty factor, the higher the belief in the conclusions from that rule. Certainty beliefs are represented by numbers. It is difficult to be clear what the certainty factor means, other than to say higher numbers mean stronger beliefs (Cohen and Gruber, 1984).

(iii) Probabilities

Bayesian probabilities can be used to quantify uncertainty but may also be a cause of uncertainty depending upon he reliability of the data used in the calculation.

The use of Dempster-Schafer mass weighting methods can reduce the uncertainty of probability base systems (Lucas and van der Gaag, 1991). The development was motivated by the observation that the probability theory is unable to distinguish between the uncertainty and ignorance owing to incompleteness of information (Patil *et al*, 1982).

In probability theory, probabilities have to be assigned to individual hypotheses, in the Dempster-Shafer theory it is possible to associate measures of uncertainty with sets of hypotheses. The theory is therefore able to distinguish between uncertainty and ignorance. The original set of hypotheses is split into subsets with confidence factors associated with each subset. New evidence alters certainty factors of competing subsets.

(iv) Fuzzy set theory and uncertainty

Fuzzy sets are possibility distributions as opposed to probability distributions. Fuzzy set theory has a number of properties which make it suitable for formalising the uncertain information upon which medical diagnosis and treatment is usually based (Adlassnig, 1986). It defines inexact medical entities as fuzzy sets, provides a linguistic approach with an excellent approximation to the clinicians vocabulary in expressing certainty and offers reasoning methods capable of drawing approximate inferences (Adlassnig, 1986).

1.5.7 The relative accuracy of automated systems

Acute abdominal pain in humans is one of the most widely studied applications of computer-aided diagnosis. Todd and Stamper (1994) compared the performance of the following systems: Causal rule-based, nearest neighbour, Independent Bayes', small Bayesian network, neural network, inferential rule based system, large Bayesian network, flowchart, and iterative partitioning. There was no significant difference at the 5 % level between the first five systems. These systems were superior to the other systems.

1.5.8 Knowledge representation and data structures

Eagle (1992) has concluded that researchers should stop trying to make a computer act like a diagnostician and concentrate instead on ways of making computer generated information which is useful to the clinicians in their decision making. Miller (1994) has suggested that decision support systems should augment reasoning by clinicians and that any model which tries to replace a clinicians reasoning should be viewed with caution.

Automated diagnostic support systems usually supply information using a single pattern recognition method or combine pattern recognition methods to produce a ranked differential list. Emphasis has been given to the theory that the knowledge representation held in memory is functional in character. Knowledge representation in the memory may not be a single interrelated structure but may be in the form of separate independent knowledge structures. For example, three structures in the form of a pathophysiological semantic network, bands of disease prevalence and a library of disease prototypes for pattern matching may be operating independently on the same information.

This thesis explores the hypothesis that one of the knowledge representations used in diagnosis may be based on a simple data structure using sign point prevalences within diseases and that nearest comparisons neighbour comparisons are used on this structure for the purposes of pattern matching.

1.6 Data structures of disease

In order to describe an algorithm of diagnosis disease attributes need to be defined in a data structure. This section describes a data structure of disease to enable the computation of the pattern matching method of pattern recognition. The data structures discussed are shown in table 1.01.

1.6.1 Sets, Venn diagrams and Boolean algebra

Feinstein (1967) described how clinical manifestations of disease can be represented using symbolic logic and set theory (table 1.01A). This enables deductive and inductive reasoning to be represented in the form of Venn diagrams and Boolean algebra. Venn diagrams are able to depict the cluster of manifestations that form the clinical spectrum of a disease. Using these approaches sets of signs representing diseases can be expressed in binary form suitable for computerisation and boolean algebraic operations (table 1.01B).

1.6.2 Point prevalence frequencies

Disease sign point prevalence frequencies are the expected frequencies if the disease is encountered (table 1.01C). The point prevalence frequencies are stage contact sensitive. If contact is predominantly at a late stage in the course of a disease the frequencies would be expected to be different from an earlier stage of contact (Wilesmith *et al*, 1992; Shortliffe *et al*, 1984). The point prevalence frequencies do not indicate the conditional dependency of the clinical signs or the frequency of occurrence of combinations of signs.

1.6.3 Disease subsets

Fernstein (1967) found that it is possible to classify the clinical signs of patients with rheumatic fever into subsets or clusters of clinical signs which had different prognoses. The point prevalence frequencies can be subdivided into similar subsets (table 1.01D). These subsets are the set frequencies required for conditional dependency in Bayes' theorem. They also represent different stages in the severity of the diseases and can be related to prognosis and specific treatments of the patient.

Clinical staging can be linked to disease subsets so that subsets can be identified by the severity of the presenting sign not merely it's presence or absence. Clinical staging of clinical signs has been described in veterinary medicine (Kasari and Naylor, 1985; Blood and Brightling, 1988).

The pattern matching problem at this subset level can be reduced to a binary solution if prevalence is ignored. All the attributes in a subset should be present, if a subset attribute is absent the disease subset can be eliminated but not necessarily the disease. Logical approaches such as investigating an attribute which is present in 50 percent of the subsets and absent in 50 percent of subsets can be applied to optimise the data driven search.

Implementation of a model using disease subsets is not possible as the subset data is not reported routinely in the literature. Current practice when reporting clinical disease surveys is to collate the data into point prevalence frequencies which have lost their subset relationships and conditional dependency (Braun *et al*, 1991). The inter-observer agreement in veterinary medicine (Martin and Bonnett, 1987) and human medicine (Koran, 1975) is low. Abnormality recognition is imperfect and exclusive models are sensitive to these errors.

The lack of information regarding disease clinical profiles has been identified as a limiting factor in veterinary (Fessler, 1984a) and human diagnosis (Croft, 1972).

Sign point prevalence frequencies for cattle diseases are available (Blood *et al* , 1989). This data structure was used for the pattern matching models described in this study.

1.7 Database information

An algorithm of diagnosis needs a source of disease information for the database. The source of the information for the comparisons is of major importance, since its accuracy has a direct influence on the accuracy of the diagnostic system itself. Among the possible sources for database are: medical text books; clinicians and experts' opinion and estimates; practice and hospital records (Rogers *et al*, 1979).

Birk *et al* (1974) and Leaper *et al* (1972) found that databases generated from medical records produced more accurate diagnoses than those generated from clinicians opinions and estimates using Bayes' algorithm. Leaper *et al* (1972) reported a diagnostic accuracy of 91.1 percent with a database generated from medical records and 82.2 percent with a database generated from physicians estimates and opinions. Birk *et al* (1974) reported accuracies of 84 percent and less than 70 percent under the respective conditions. This gives strong support for a database generated from medical records. Gustafason *et al* (1971) according to Rogers *et al* (1979) found that a database developed from subjective probabilities performed just as well and required less time and cost. Retrospective records are often data deficient unless standardised collection methods are used (Rogers *et al*, 1979).

This study used sign point prevalence frequencies compiled by a group of experienced veterinarians. The source of the information was " Bovid" (Blood *et al* , 1989).

1.8 Model validation

Algorithms need to be evaluated to establish their diagnostic accuracy.

Algorithms when applied in different studies with different data can yield drastically different accuracies. Validation of the system requires an appropriate test sample and an independent criterion of the correct diagnosis for each patient. The test sample should consist of new patients whose medical records were not used to derive the database. Many studies ignore this requirement (Fisher *et al*, 1975 according to Rogers *et al*, 1979).

The diagnostic accuracy of the algorithm is usually expressed as the percentage ratio of the correct diagnoses to attempted diagnoses. It is more meaningful to compare the performance with clinicians (Rogers *et al*, 1979).

This study used literature case report as a test sample for the model and compared the model to a group of large animal veterinarians.

Chapter 2
Pattern Recognition Survey

2.1 Introduction

The recall and ranking of differential diagnoses when presented with a list of clinical abnormalities are important procedures in diagnosis. A function used in these procedures is pattern recognition. Three methods of pattern recognition are: functional pattern recognition in the form of pathophysiological and anatomical reasoning, probabilities and pattern matching (Schmidt *et al*, 1990). The purpose of this study was to identify the pattern recognition methods perceived to be used by final year veterinary students and experienced veterinarians.

2.2 Materials and Methods

A questionnaire was sent to 57 veterinarians and 48 final year veterinary students. The veterinarians in the survey held a Royal College of Veterinary Surgeon's Certificate in either Cattle Health and Production or in Bovine Reproduction. The final year veterinary students were from the University of Cambridge Veterinary School and were in their final term. The replies were anonymous. The questionnaire is presented below.

Questionnaire

Introduction

An important function in veterinary medicine is deciding on a ranked list of differential diagnoses when presented with a list of clinical signs. This process is called pattern recognition.

Three methods of pattern recognition are:

1. Pattern matching

The clinical signs observed are compared to profiles or descriptions of diseases in memory. The differential diagnosis list is constructed according to which of the disease profiles most closely match the clinical signs.

2. Probabilities

A probability is computed using the prevalence of the diseases in the population and the frequency of occurrence of the clinical signs observed within those diseases. The differential list is then constructed from the disease probabilities.

3. Pathophysiological reasoning

Using the clinical signs observed the system and the lesion within the system is identified using knowledge of disease mechanisms (pathophysiology and anatomy). A differential diagnosis list is then constructed using diseases which could explain the disease processes identified.

Questions

1. Which pattern recognition method do you use most frequently?

    (i) Pattern matching
    (ii) Probabilities
    (iii) Pathophysiological reasoning

2. Are there any of these methods which you never use?

Table 2.01 Pattern recognition methods used by final year veterinary students

	Pattern matching	Probabilities	Patho-physiology
Method used most frequently	4 (16.7%)	3 (12.5%)	17 (70.8%)
Method never used	0	4 (16.7%)	0

Table 2.02 Pattern recognition methods used by certificate holding veterinarians

	Pattern matching	Probabilities	Patho-physiology
Method used most frequently	17 (47.2%)	9 (25.0%)	10 (27.8%)
Method never used	0	3 (8.3%)	0

2.3 Results

There were 36 (63.2%) questionnaires returned from the veterinarians and 24 (50.0%) from the veterinary students. The results for the students are presented in table 2.01 and the veterinarians in table 2.02.

The most commonly used method of pattern recognition by the students was pathophysiological reasoning (70.8%). The most commonly used method by the veterinarians was pattern matching (47.2%). All three methods were used by 83.3% of the students and 91.7% of the veterinarians. Probabilities were not used by 16.7% of the students and 10% of the veterinarians. All the students and veterinarians used pattern matching and pathophysiological reasoning.

There were statistically significantly more veterinarians using pattern matching rather than probability and pathophysiological reasoning when compared to the veterinary students using a Chi-squared test with Yates correction ($p=0.015$). There were statistically significantly more veterinary students using pathophysiological reasoning rather than pattern matching or pathophysiology reasoning when compared to the veterinarians using a Chi-squared test with Yates correction ($p=0.001$).

2.4 Discussion

This was a subjective survey and interpretation must be viewed with caution. Subjects may think they are using one method when they may be using another method. In this survey the veterinary students and veterinarians recognised the three pattern recognition methods described in the survey and in general used all three methods.

The veterinary students perceived that they used pathophysiological or functional reasoning most frequently compared to the other methods. The clinicians perceived that they used pattern matching most frequently.

Schmidt *et al* (1990) have presented a stage theory of clinical reasoning. Intermediate-level students without clinical experience typically use pathophysiological causal models of disease when solving problems. More experienced clinicians use pattern matching and recall previous case presentations.

It has been recognised that pattern matching ability is a function of experience and that pattern matching is a major factor in pattern recognition (Rogers *et al*, 1979; Barrows and Bennett, 1972; Kassirir *et al*, 1982 and Elstein *et al*, 1978.

Bayes' theorem probabilities require large amounts of accurate data and the computations involved may be beyond human ability (Fischoff and Bayth-Marom, 1983). Studies in human medicine indicate that clinicians do not apply probabilities accurately in decision making (Fischoff and Bayeth-Marom, 1983; Christian- Szalanski, 1981). Clinicians may believe they are using probabilities when they actually using certainty factors or weighting (Gorry, 1973).

Pathophysiological or functional reasoning is well recognised (Hammond *et al*, 1989) as a pattern recognition method and is supported by detailed teaching of related subjects. The veterinarians and veterinary students recognised this pattern matching method as part of their decision strategies.

This survey of experienced veterinarians and veterinary students supports the hypothesis that there is a shift in the pattern recognition method used from deterministic (pathophysiological reasoning) to experiential (pattern matching) methods. However, both groups acknowledged that these are not exclusive and that all three methods are perceived to be used by each group. This suggest that veterinary education should include structured teaching of pathophysiological, pattern matching and probability, pattern recognition methods.

Chapter 3
Logical Exclusion and Pattern Recognition

3.1 Introduction

Implicit in the application of symbolic reasoning as embodied in set theory, Venn diagrams and boolean algebra is the concept of logical exclusion (Ledley and Lusted, 1959; Feinstein, 1967).

Logical exclusion is the exclusion of a disease from further consideration in the diagnostic process if one of the following conditions apply:

1. A sign is observed to be present which has never been recorded for the disease under consideration

   OR

2. A sign is observed to be absent when it is always present in the disease under consideration.

This is a powerful strategy for reducing the number of differential diagnoses under consideration. If this strategy is applied to unreliable data the diagnosis can be excluded from further consideration with a resultant misdiagnosis. This survey was designed establish if veterinarians recognise this strategy and how they use this strategy.

During a clinical examination data is collected. Signs are checked and classified as present or absent. There are usually many more negative findings than positive findings. Maximising the discriminatory power of the collected data necessitates the use of positive and negative findings. In general the positive data has a greater discriminatory power than the negative data. This survey investigated the data perceived to be used by subject veterinarians in the process of pattern recognition.

3.2 Materials and methods

A questionnaire was sent to 57 veterinarians. The veterinarians in the survey held a Royal College of Veterinary Surgeon's Certificate in either Cattle Health and Production or in Bovine Reproduction. The replies were anonymous. The questionnaire is presented below.

Questionnaire

Logical exclusion

Logical exclusion is the elimination of a disease from further consideration from the differential diagnoses list under the following two circumstances:

(i) A sign is observed to be present which has never been recorded for the disease under consideration (Milk fever would be excluded if jaundice was observed)

OR

(ii) A sign is observed to be absent when it is always present in the disease under consideration. (Milk fever would be excluded if hypocalcaemia was absent)

1. During clinical diagnosis do you ever use logical exclusion when formulating your differential diagnosis list?

Yes/No

2. Do you agree with the following statement:

Logical exclusion is only used when the veterinarian is confident that an abnormality exists or does not exist and it is relevant to the purpose of the investigation.

(e.g Kicking in the parlour may be normal for some cows or the presence of warts on a cows teats would be ignored if the cow was a post calving downer cow)

Yes/No

Data used in ranking differential diagnoses

When ranking the diseases on your differential diagnosis list (deciding which disease is more likely than another)
do you:

(i) Consider only the signs observed to be **PRESENT** on clinical examination?

OR

(ii) Consider the signs which were observed to be **Present** and those observed to be **ABSENT** on clinical examination?

Answer (i) OR (ii)

3.2 Results

The results are shown in table 3.01. There were 33 forms returned. All the veterinarians used logical exclusion. Eighty eight percent agreed that logical exclusion must be used only when the clinician was confident that the abnormality was present and that the abnormality was relevant to the problem under investigation.

A high proportion (94%) of the veterinarians indicated that they take into account the signs observed to be present and the signs observed to be absent during the process of diagnosis.

3.3 Discussion

Logical exclusion is a strategy which is used by the subject veterinarians during pattern recognition. The dangers of using logical exclusion with unreliable data is well recognised and is reflected by the experimental subject group (White 1984, 1988b). However this strategy does not deal with uncertainty in diagnostic reasoning and does not represent the reasoning strategies used under uncertainty (Cohen and Gruber, 1984).

The inclusion of data regarding clinical signs which are checked but are found to be absent in the pattern recognition process optimises the use of the available data. Although the majority of veterinarians in the experimental group claimed to use the signs observed to be present and the signs observed to be absent may be that this is the way in which they think they should use the available data rather than the way in which they actually use the data. Signs which are present rather than signs which are found to be absent are more likely to be used in a limited search space as they have greater discriminatory power (Blois, 1980; Burbank, 1969).

Table 3.01 Logical exclusion and data used in pattern recognition

	Number	%
Forms returned	33	58
Veterinarians using logical exclusion	33	100
Logical exclusion applied when confident sign is present/absent and relevant to investigation	29	88
Only signs observed to be present used in analysis	2	6
Signs observed to be present and absent used in analysis	31	94

This survey has demonstrated that logical exclusion is a strategy used in veterinary practice provided there is a high level of confidence that the abnormality exists and that it is pertinent to the problem under investigation. The veterinarians also recognised that optimum utilisation of clinical data is achieved by using all the data, namely the signs observed to be present and the signs observed to be absent.

Chapter 4
Pattern Matching Models used in the Study

4.1 Introduction

In medicine the presence or absence of signs may be definitive for classification of the patient as abnormal or into a category of a specific disease. Classification can be by logical exclusion or list matching (Shortliffe, 1976). However when multiple signs are combined the possibility increases that a disease will be excluded from the list because of human error or entry of an inaccurate or inconsistent description. Accurate recognition of signs presented by the patient remain crucial. If a sign is overlooked or misinterpreted during the physical examination any search based on that information is irrelevant to the actual disease (White, 1984).

Matching procedures compare a patients symptom profile with the profiles in the database. These may be a calculated average symptom profile (a prototype or an ideal type). The most common of the matching procedures involves the assignment of a weight to each sign for each disease. The signs of a new patient are then summed according to their weight for each disease. The disease which produces the largest ratio of the patients weighted symptoms to the weighted sum of all characteristics for that disease is considered the correct diagnosis (Rogers *et al*, 1979).

A pattern matching problem begins with class definitions. Distance measures are often used. These may be any distance measurement that is a valid representation. Distance is a crucial concept, the closer a point is to another point the more similar the patterns represented by those points. Identifying a point as a member of a class is called nearest neighbour pattern classification and it assumes that the distance between the points is a legitimate measure of the similarity of the patterns they represent (Meisel, 1972).

In order to find the diagnostic pattern or discriminant function a training set of objects for which the correct classification is known as well as reliable values for their measured features is required. The pattern can then be compared to new unclassified objects in order to decide in which category the new object should be placed (Kulikowski, 1984; Shortcliffe *et al*, 1984).

Pauker *et al* (1976) measured the fit of case abnormalities to the hypotheses using a scoring process with numerical values that reflected the likelihood that various clinical findings would occur in the disorder. Major features were given more weight in the final score process than minor features.

An attribute is the property of an object (Smith, 1990). In the context of clinical signs it refers to a property of a disease. For example, flaccid paralysis is an attribute of the disease parturient paresis in cattle. An attribute can have a value which reflects a specific case, for example frequency of the attribute flaccid paralysis in parturient paresis is 80 percent. The frequency of occurrence of a sign within a disease is known as the point prevalence frequency (Blood *et al*, 1988). An attribute can also be used to describe predisposing factors such as age or breed.

4.2 The general model schema

In this study clinical sign point prevalence frequencies were used as a measure of distance between the observation of the sign and the disease profile. The higher the frequency the closer the match to the observation. Each disease is assumed to conform to an ideal type profile represented by the point prevalence frequencies of the attributes observed within that disease.

The point prevalence frequencies of the disease attributes used in this study were obtained exclusively from Bovid version two (Blood *et al*, 1989). The point prevalence frequencies contained within the database were compiled by an expert panel of clinicians and are not based on clinical case reports.

In this pattern matching model an attribute can represent either a clinical sign or a predisposing factor. The value assigned to the attribute in a specific disease is the point prevalence frequency. This model when presented with an input of disease attributes:

1. identifies the disease with the best fit profile using attribute point prevalence frequencies (PPF) and

2. identifies the disease attribute which has the greatest differentiating value relative to the competing differential diagnoses.

To demonstrate the model a two dimensional array data structure will be used. This is presented in tables 4.01 and 4.02. These tables present the disease attribute point prevalence frequencies of attributes 1,2,3 and 4 for the diseases A,B,C and D when the attribute is observed to be present (table 4.01) and when the attribute is observed to be absent (table 4.02). Table 4.02 represents the compliment values of table 4.01.

Attribute point prevalence frequencies are used as a measure of how closely the disease description matches the observation. If an attribute is observed the attribute point frequency in table 4.01 is used. If an attribute is absent the attribute point prevalence frequency in table 4.02 is used.

4.2.1 Pattern matching

Attribute present

If an attribute is observed to be present the point prevalence frequency of that attribute for each disease (table 4.01) is added to the profile total for each disease.

Attribute absent

If an attribute is examined and is found to be absent a value equivalent to the compliment of the attribute value shown in table 4.01, i.e. (100-(attribute point prevalence frequency if attribute present)) is used. These values are shown in table 4.02. Theses values are added to the profile total for each disease.

Profile total

The profile total is the sum of the attribute point prevalence frequencies computed for the attributes examined. The disease with the greatest profile total is the leading hypothesis as it most closely resembles the observations.

Profile score

The profile score represents the level of agreement between the disease and the observations.
Profile score =
((Profile total/((number of observations)(100)))(100)) %

A profile score of 100 percent represents an exact match between the observations and the disease attribute point prevalence frequencies.

Logical exclusions

Two situations exist where it is possible to logically exclude a disease from further consideration. If an attribute is observed and found to be present but should be absent (PPF=0) in a disease or an attribute that is observed and found to be absent but should be present in a disease (PPF=100). Exclusion is a risky procedure and is only suggested for attributes with which can be recognised with certainty.

4.2.2 Identification of the next attribute to be examined

The optimisation of information retrieval requires the identification of the attribute which will maximise the shift in profile score between the leading hypothesis and the competing hypotheses at the next observation.

The absolute differences between the attribute PPFs of the leading hypothesis and the competing hypotheses for each attribute which has not been examined are summed. The largest score is the attribute to be examined next. There is no difference in this result of this calculation if either the attribute is assumed to be present (table 2.01) or the attribute is assumed to be absent (table 2.02).

4.3 Example using the hypothetico-deductive pattern matching model of veterinary diagnosis

This example uses the data in tables 2.01 and 2.02. Assume attribute 1 is examined and is found to be present. The profile totals are:

	Diseases			
	A	B	C	D
Profile totals	80	60	20	0

A is the leading hypothesis because it has the highest profile total and D is logically excluded because this attribute 1 is never seen in disease D.

The absolute differences between the attribute PPFs of the leading hypothesis A and the attribute PPFs of the competing hypotheses B and C for the attributes 2,3 and 4 are presented below.

	Diseases			
Attribute	A	B	C	Sum of absolute differences
1	80	60	20	Examined
2	100	20	20	160
3	20	0	80	80
4	0	20	80	100

Attribute 2 has the greatest differentiating value so this is examined next and is found to be absent.

Disease A is logically excluded as this attribute should always be encountered in disease A.

The profile totals of B and C are:

		Diseases	
		B	C
Attributes	Status		
1	Present	60	20
2	Absent	80	80
Profile totals		140	100

The leading hypothesis is B.

The profile scores are:

B=140/200= 70%
C=100/200= 50%

The percentage agreements between the ideal profiles and the attributes of diseases B and C are 70 percent and 50 percent respectively.

Table 4.01 **Point prevalence frequencies of attributes, 1, 2, 3 and 4 within diseases A, B, C and D when the attributes are observed to be present.**

	Diseases A	B	C	D
Attributes				
1 Present	80	60	20	0
2 Present	100	20	20	60
3 Present	20	0	80	20
4 Present	0	20	80	60
Totals	200	100	200	140

Table 4.02 **Point prevalence frequencies of attributes, 1, 2, 3 and 4 within diseases A, B, C and D when the attributes are found to be absent.**

	Diseases A	B	C	D
Attributes				
1 Absent	20	40	80	100
2 Absent	0	80	80	40
3 Absent	80	100	20	80
4 Absent	100	80	20	40

4.4 Pattern matching models used in the thesis

Pattern Matching Model 1

The point prevalence frequencies for the signs observed to be present for each condition in the database are summated. No logical exclusion is applied.

Pattern Matching Model 2

The point prevalence frequencies for the signs observed to be present for each condition in the database are summated and logical exclusion is applied. Conditions are excluded if a sign is observed which is never seen in the condition or a sign is absent which should always be present.

Pattern matching Model 3

The point prevalence frequencies for the signs observed to be present and those signs observed to be absent are summated. No logical exclusion is applied.

Pattern matching Model 4

The point prevalence frequencies for the signs observed to be present and those signs observed to be absent are summated and logical exclusion is applied. Conditions are excluded if a sign is observed which is never seen in the condition or a sign is absent which should always be present.

A hypothetico-deductive pattern matching model of veterinary diagnosis. Model 5

Model 1 with the attribute to be examined next using the method outlined in 4.3.

Chapter 5
Pattern Recognition Analysis

5.1 Introduction

This experiment was designed to identify the pattern recognition method used by the veterinarians during the recall and ranking of differential diagnoses.

5.2 Materials and Method

Eighteen cattle disease case reports from the published literature were used. The case reports consisted of clinical signs (e.g jaundice) and risk factors (e.g age). All the information contained within the case reports was presented. The clinical information presented and their references are listed in table 5.01. The case reports used the nomenclature from the bovid glossary of clinical attributes (Blood *et al*, 1989).

The case reports were presented to six members of the Department of Production Animal Medicine and Surgery of the Faculty of Veterinary Science, Medical University of Southern Africa (Medunsa). The Department of Production Animal Medicine and Surgery provides veterinary services for production animals in the surrounding districts and also receives referral cases. Although there was specialisation by academic qualification all the veterinarians took part in the practice duties and were expected to attend all cases presented. The veterinarians under took the study on the basis of anonymity. The only identifier was by rank according to their experience of cattle diseases presented in table 5.02. The code given was the identifier used throughout the study. Experience in cattle diseases was defined by the number of years spent in cattle practice or related employment.

Table 5.01 Case reports

1. Salt poisoning

(Pearson and Kallfelz, 1982)

Calf less than 3 months old
Temperature > 39,9 C
Respiration increased and shallow
Feed intake < 50% of normal
Nystagmus
Recumbency
Convulsions
Blood neutrophilia

2. Ruptured bladder

(Smith *et al*, 1983)

Female
Adult
Aberdeen angus
First month post partum

Temperature > 39,5
Respiration increased and shallow
Rumen movements absent
Dehydration
Weight gain reduced or weight loss
Feed intake < 50% of normal
Milk yield below normal
No urine passed
Abdominal distention
Free fluid in Abdomen
Abdominocentesis yields urine
Faeces dry and firm
Blood BUN elevated
Blood creatinine elevated

3. Post parturient haemoglobinuria

(Penny, 1956)

Female
Adult
Shorthorn
First month post partum

Temperature >39.5 C
Heart rate > 100 per minute
Mucosae pale
Mucosae jaundiced
Urine red
Erythrocyte count low

4. Bovine renal amyloidosis

(Murray *et al*, 1972)

Female
Adult
Ayrshire

Rumen rate decreased (< 1 per 2 minutes)
Weight gain reduced or weight loss
Recumbency
Submandibular oedema
Brisket oedema
Persistent diarrhoea
Kidney(s) enlarged or painful
Urine contains protein
Blood protein low

5. Monensin poisoning

(Medunsa case report)

Male
Adult

Heart rate > 100 per minute
Rumen movements absent (0 per 2 minutes)
Feed intake reduced < 50% of normal
Lying down most of the time
Hyposensative to external stimuli
Submandibular oedema
Brisket oedema
Jugular pulse increased
Jugular veins distended
Heart sounds soft/muffled

6. Bovine spongiform encephalopathy

(Scott *et al*, 1988)

Female
Adult
Dry cow

Course of disease more than 2 weeks
Temperature > 39.5
Respiration increased and shallow
Gait stumbling
Gait stiff
Bach arched
Aggressive actions
Frenzy
Tail tetany
Hind legs flexed
Tremor

7. Malignant catarrhal fever

(Milne and Ried, 1990)

Female
Adult
Galloway

Temperature > 39,5
Rumen movements absent (0 per 2 minutes)
Feed intake < 50% of normal
Gait stumbling
Corneal opacity
Corneal ulceration
Ocular discharge purulent
Oral mucosal erosions
Oral mucosal ulcers or necrosis
Nasal discharge purulent
Breath foul smelling
Drooling saliva
Tremor
Lymphnodes enlarged

8. Rabies

(Schnurrenberger *et al*, 1970)

Male
Adult
Hereford

Temperature > 39.5 C
Gait stumbling
Difficulty rising
Bellowing excessively
Drooling saliva
Rectal prolapse
Paralysis

9. Ephemeral fever

(Young and Spradbrow, 1990)

Male
Weaning to 2 years

Temperature > 39.5 C
Respiration increased and shallow
Heart rate > 100 per minute
Rumen movements absent (0 per 2 minutes)
Feed intake < 50% of normal
Gait stiff

10. Mucosal disease

(Torgerson *et al*, 1989)

Female
Adult
Aberdeen angus
Lactating

Course of disease more than 2 weeks
Temperature < 38 C
Dehydration
Oral mucosal ulcers or necrosis
Interdigital cleft necrotic fissure
Faeces contain fresh blood
Erythrocyte count high
Blood BUN elevated

11. Bovine valvular endocarditis

(Cabana *et al*, 1990)

Female
Adult
Limousin

Heart rate > 100 per minute
Feed intake < 50% of normal
Reluctant to walk
Brisket oedema

12. Sporadic bovine leucosis

(Brightling and Lancombe, 1989)

Weaning to 2 years
Male
Friesian

Heart rate < than 80 per minute
Weight gain reduced or weight loss
Abdominal distention
Liver enlarged or painful
Lymph nodes enlarged

13 Bovine ketosis

(Cote *et al*, 1969)

Female
Adult
Friesian
First month post partum

Weight loss
Milk yield below normal
Urine ketones
Blood sugar low

14. Subacute lead poisoning

(Medunsa case report)

Female
Weaning to 2 years
Friesian

Rumen movements absent
Gait stiff
Reluctant to walk
Head pressing
Jaw champing
Menace response absent
Drooling saliva

15. Traumatic reticulo-pericarditis with heart failure

(Brightling and Lancombe, 1989)

Male
Adult
Jersey

Respiration increased and shallow
Heart rate > 100 per minute
Weight gain reduced or weight lost
Submandibular oedema
Brisket oedema
Jugular pulse absent
Jugular veins distended
Heart sounds soft/muffled
Pericardio-centesis yields inflammatory fluid
Liver enlarged or painful

16. Pyrexia pruritus and haemorrhage

(Holden, 1980)

Female
Adult
Friesian

Temperature > 39.5 C
Mucosal haemorrhages
Milk yield below normal
Self licking, rubbing and chewing
Hair loss locally

17. Post parturient paresis

(Hemsley, 1957)

Adult
Female
Friesian
Immediately post partum

Temperature < 38.0 C
Feed intake < 50% of normal
Recumbency
Pupillary dilatation
Eyelid paralysis
Pupillary light response absent
Muzzle dry
Limber neck
Blood creatinine phosphokinase levels elevated
Blood calcium low

18. Copper deficiency

(Smart *et al*, 1981)

Female
Weaning to two years
Simmental
Animal grazing pastures

Mucosae pale
Weight gain reduced or weight lost
Gait stiff
Reluctant to walk
Joint enlargement
Blood haemoglobin low

For each case report the veterinarians had to recall and rank appropriate differential diagnoses.

The veterinarians were given a copy of the diagnosis summaries from the book "Diseases of Cattle: a manual of diagnosis" (Blood *et al*, 1990). This section contained the clinical indicants recorded in the Bovid database for all the diseases of cattle. The veterinarians were also given a questionnaire which contained the following statements:

"The clinical findings listed were recorded at a single clinical examination. All the findings reported are presented. The condition described is an uncomplicated single condition. List the differential diagnoses and score them according to the following confidence rating scale:

Confidence rating scale

1.	100%	(Convinced of diagnosis)
2.	80%	(Very likely)
3.	60%	(Likely)
4.	40%	(Unlikely)
5.	20%	(Very unlikely) ".

The confidence ratings of the differential diagnoses produced by the veterinarians were analyzed using three models of pattern recognition to identify which model most closely resembled the veterinarians. The three models were:

(1) a pattern matching model using the pattern matching model 1 described in chapter 4. The point prevalence frequencies for the signs observed to be present for each condition in the database are summated. Logical exclusion is not applied.

(2) Bayes' theorem probability (the probability of the disease being the diagnosis given the set of attributes) assuming conditional independence and

(3) Bayes' theorem probability with conditional independence assuming the diseases have equal prevalence (the probability that a disease explains the set of clinical attributes).

The point prevalence frequencies of the disease attributes used in this study were obtained exclusively from Bovid version two (Blood *et al*, 1989). The point prevalence frequencies contained within the database were compiled by an expert panel of clinicians and are not based on clinical case reports. The disease prevalence used by Bovid and other calculations in this study were compiled from case reports and personal records from Medunsa. These prevalence values should reflect the disease prevalence expected by the veterinarians. The Bayes' theorem formula used is described in appendix one.

Equivalence intervals

The veterinarian confidence rating categories 20, 40, 60, 80 and 100 were assigned equivalence intervals for the three models of pattern recognition. These are shown in table 5.03.

This classification enabled statistical comparisons to be made to identify which method of pattern recognition most closely resembled the confidence ratings produced by the veterinarians.

Table 5.02 Veterinarian rank according to experience in cattle disease

Experience	Rank	Code of veterinarian
Most experienced	1	V1
	2	V4
	3	V5
	4	V6
	5	V3
Least experienced	6	V2

Table 5.03 The equivalence intervals of the pattern matching, probability and probability assuming equal models for the confidence rating categories of the veterinarians.

Confidence rating		Equivalence intervals		
Category	Definition	Pattern matching score	Prob-ability	Probability equal prevalence
20	Very unlikely	>0-20	>0-20	>0-20
40	Unlikely	21-40	21-40	21-40
60	Likely	41-60	41-60	41-60
80	Very likely	61-80	61-80	61-80
100	Convinced diagnosis	81-100	81-100	81-100

Deviation by category

According to the equivalence intervals in table 5.03:
if a confidence rating of 40 was assigned to a pattern matching score of 57 then the deviation by category was +1;
if a confidence rating of 80 was assigned to a pattern matching score of 22 then the deviation by category was -2.

Correct and incorrect categorisations

According to the equivalence intervals in table 5.03.
If the value for a differential diagnosis produced by a model was within the equivalence interval defined by the confidence rating given to that differential diagnosis by the veterinarian then the model and the veterinarian were in agreement. For example, if a differential diagnosis had been given a confidence rating of 40 by the veterinarian the interval equivalent for the models would be 21-40. If the value for the pattern matching model was 35 for the same differential diagnosis the pattern matching model and the veterinarian would be in agreement. If the values for the differential diagnosis using the probability model and the probability model assuming equal were 45 and 55 respectively they would be outside the equivalence intervals and would be incorrectly categorised.

Bovid

For comparative purposes the same case reports were analyed using Bovid (Blood *et al*, 1989), a diagnostic decision support system with a database of cattle diseases . Version two was used in this study. This system uses Bayes' theorem assuming conditional independence to compute the probability of the disease occurring given the clinical information presented. In order to compute the probabilities bovid demands an exclusive pivotal attribute A pivotal attribute is an attribute which the observer can identify with absolute certainty. The pivotal attributes listed in appendix two were used in the generation of the differential diagnoses by Bovid for the case reports.

5.3 RESULTS

5.3.1 Pattern recognition

The differential diagnoses and their confidence ratings recorded by the six veterinarians for the 18 case reports which were present in the Bovid database are presented in appendix three. They are ranked according to their pattern matching profile scores within cases.

(i) Pattern matching and Bayes' theorem probabilities

The pattern matching score, Bayes' theorem probability and Bayes' theorem probability assuming equal prevalence for the differential diagnoses against the confidence rating for each veterinarian across the case reports are presented in figures 5.01-5.18.

The pattern matching model produced a clustered distribution within the confidence rating categories suggesting a functional relationship.

(ii) Tests for normality

If a particular pattern recognition method was being used by the veterinarians the error around the true value would be have a "normal" (Gaussian) distribution.

A Wilk-Shapiro/Rankit plot was used to examine the distribution for each veterinarian within each confidence rating category 20, 40, 60, 80 and 100 for the three pattern recognition methods under analysis.

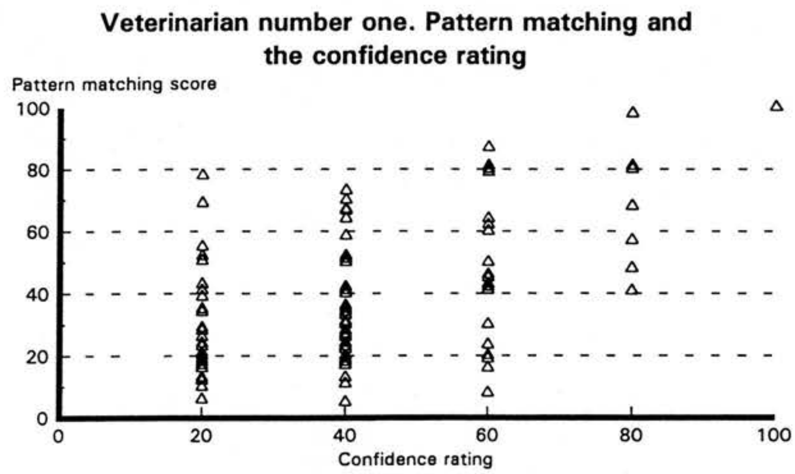

Fig 5.01 The pattern matching score against confidence rating of the differential diagnoses of veterinarian number one

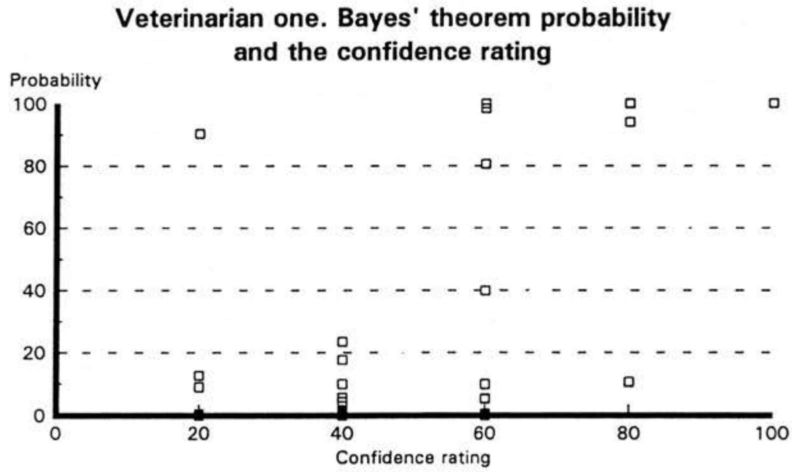

Fig 5.02 Bayes' theorem probability against the confidence rating of the differential diagnoses of veterinarian number one.

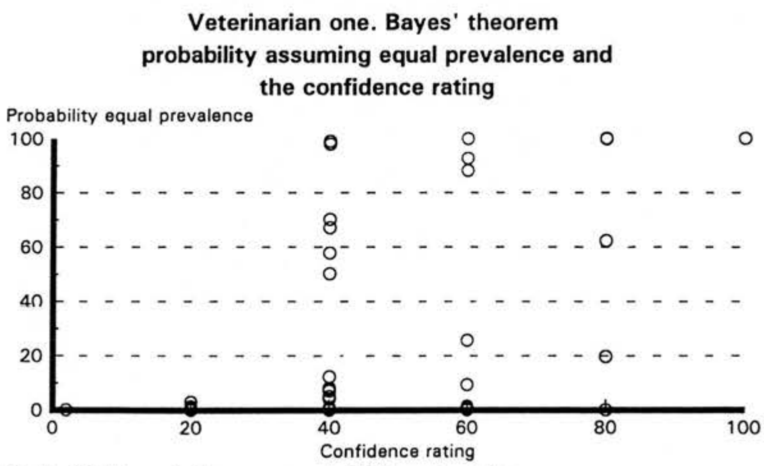

Fig 5.03 Bayes' theorem probability assuming equal prevalence against the confidence rating of the differentials of veterinarian one

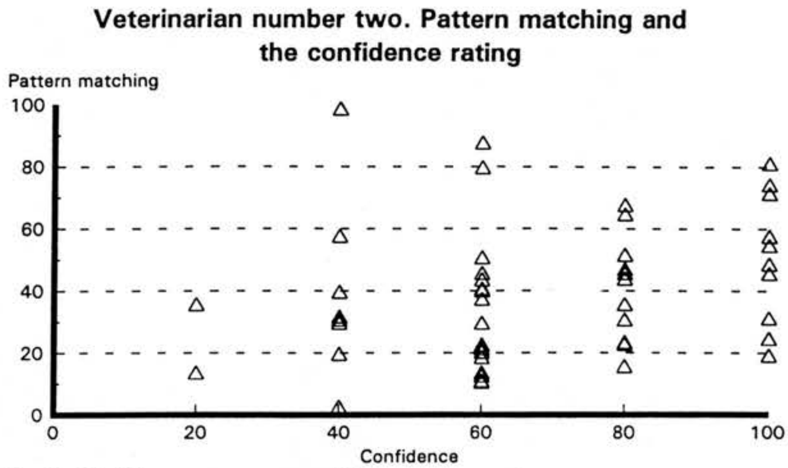

Fig 5.04 The pattern matching score against the confidence rating of the differential diagnoses of veterinarian two

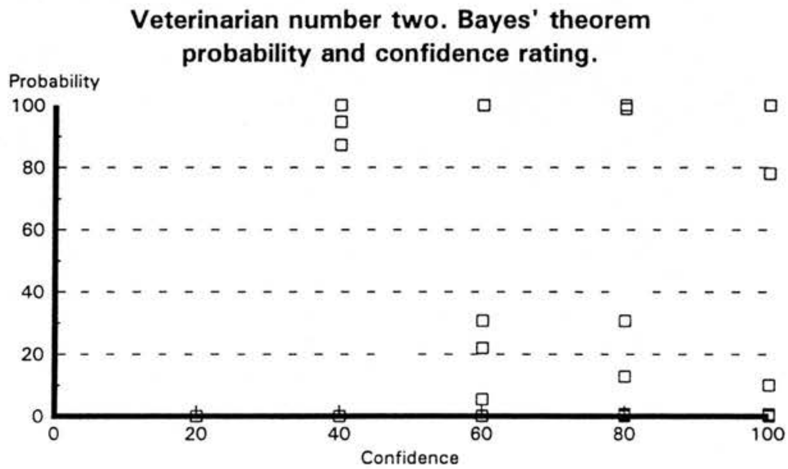

Fig 5.05 Bayes' theorem probability against confidence rating of the differential diagnoses of veterinarian number two.

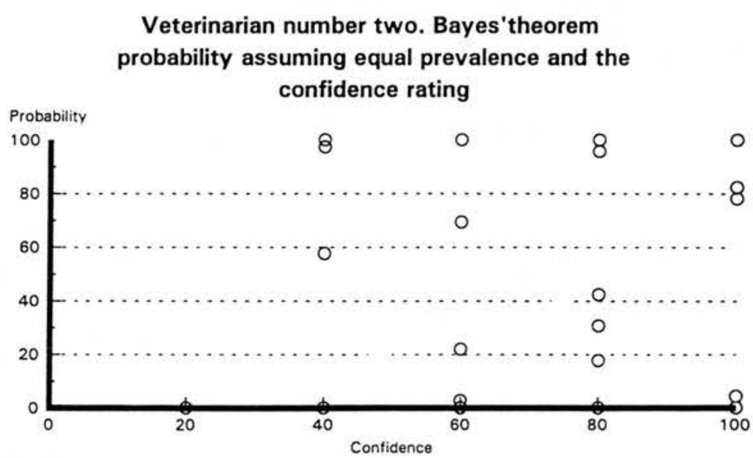

Fig 5.06 Probability assuming equal prevalence against the confidence rating of the differential diagnoses of veterinarian number two

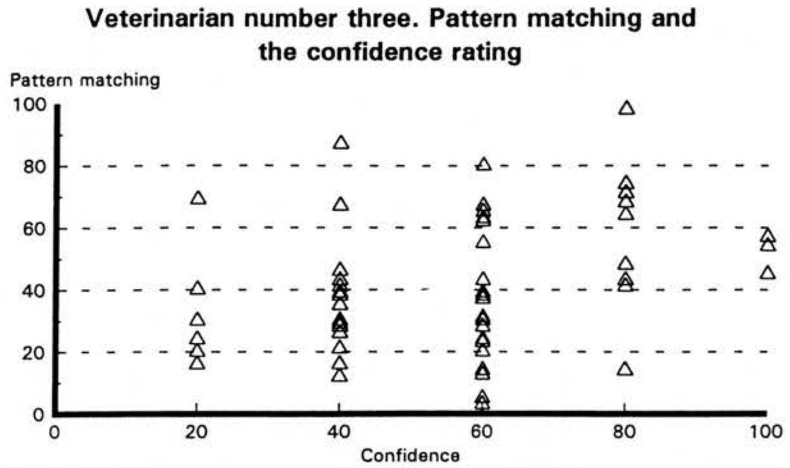

Fig 5.07 The pattern matching score against the confidence rating of the differntial diagnoses of veterinarian number three

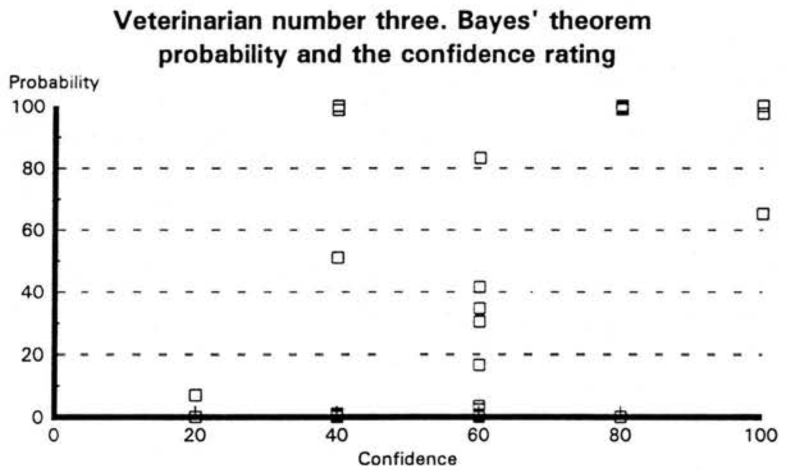

Fig 5.08 Bayes' theorem probabilty against the confidence rating of the differential diagnoses of veterinarian number three

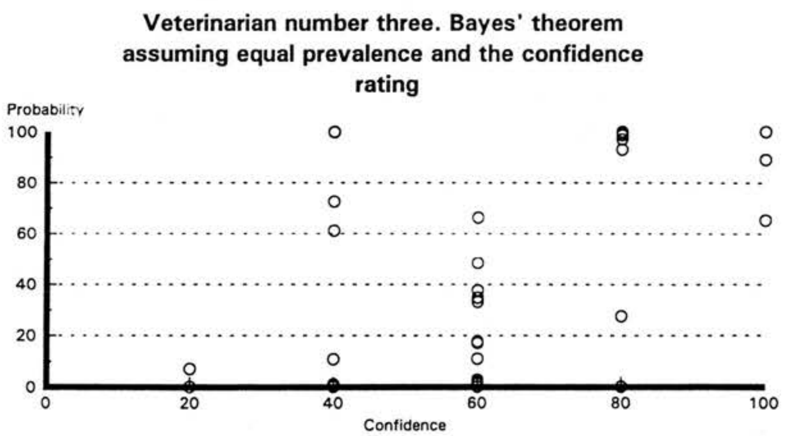

Fig 5.09 Probability assuming equal prevalence against the confidence rating of the differential diagnoses of veterinarian number three.

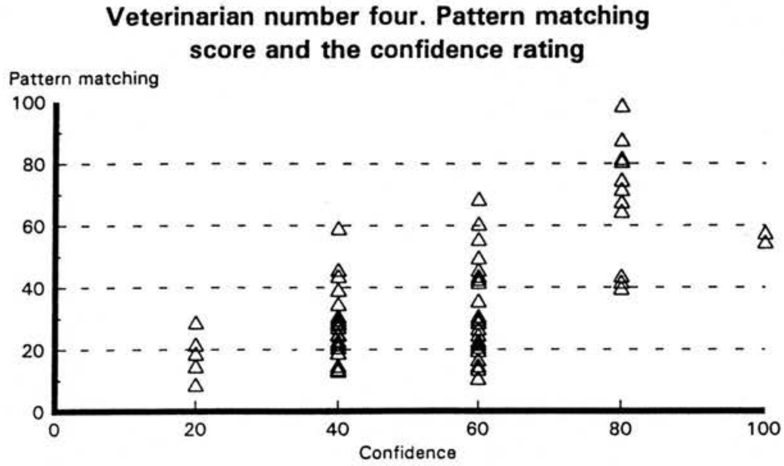

Fig 5.10 The pattern matching score against the confidence rating of the differential diagnoses of veterinarian number four.

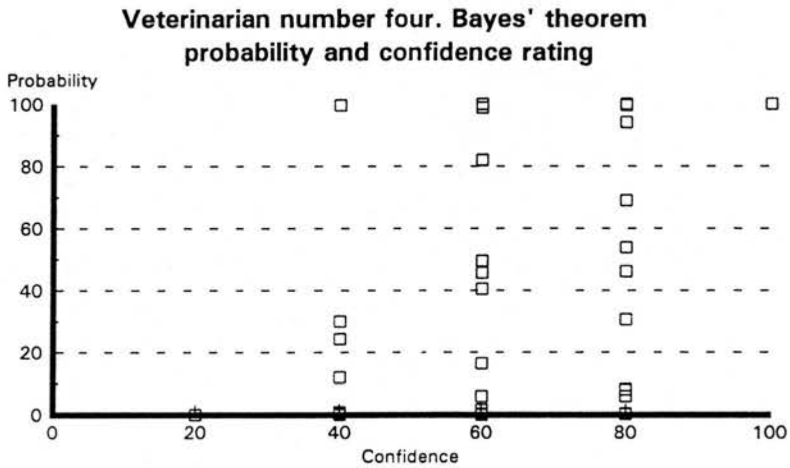

Fig 5.11 Bayes' theorem probability against the confidence rating of the differential diagnoses of veterinarian number four

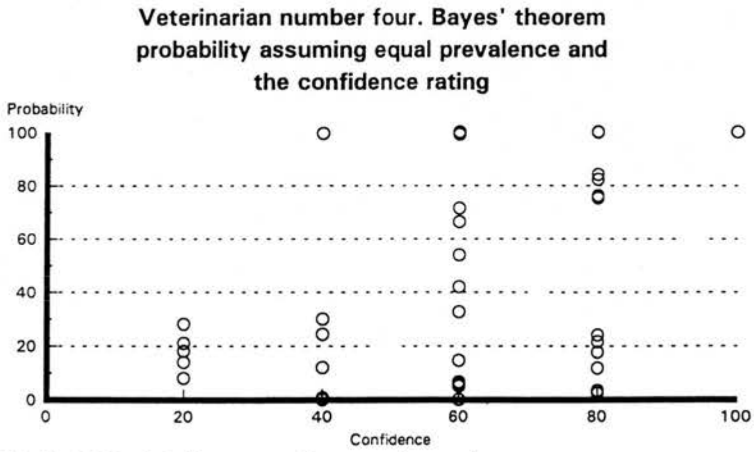

Fig 5.12 Probability assuming equal prevalence against the confidence rating of the differential diagnoses of veterinarian number four

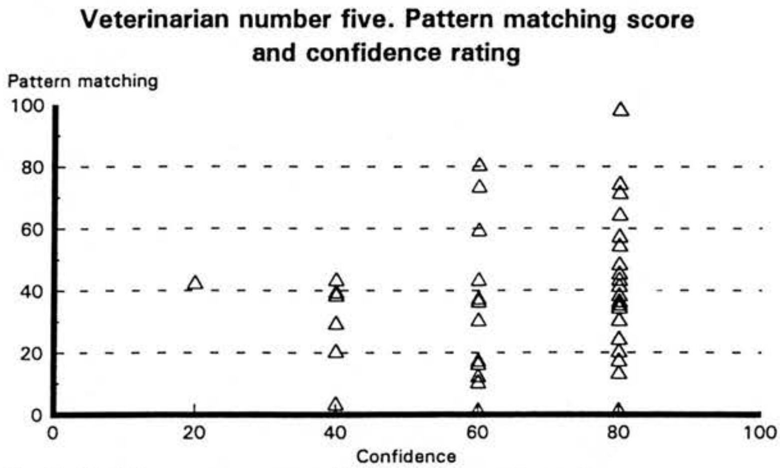

Fig 5.13 The pattern matching score against the confidence rating of the differential diagnoses of veterinarian number five

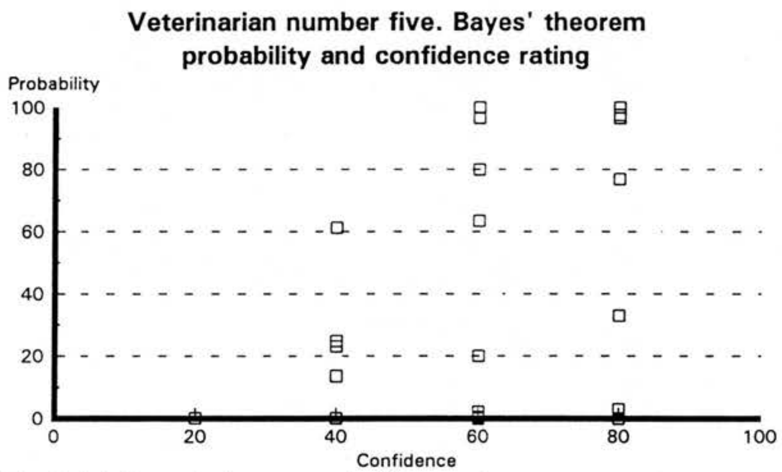

Fig 5.14 Bayes' theorm probabilty against the confidence rating of the differential diagnoses of veterinarian number five

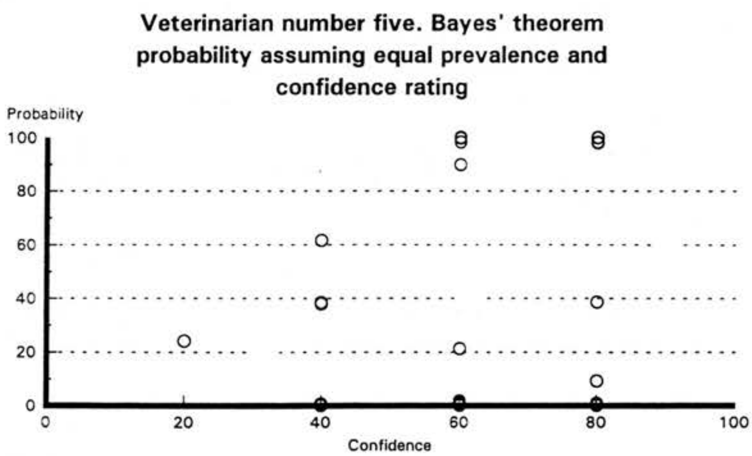

Fig 5.15 Probability assuming equal prevalence against the confidence rating of the differential diagnoses of veterinarian five.

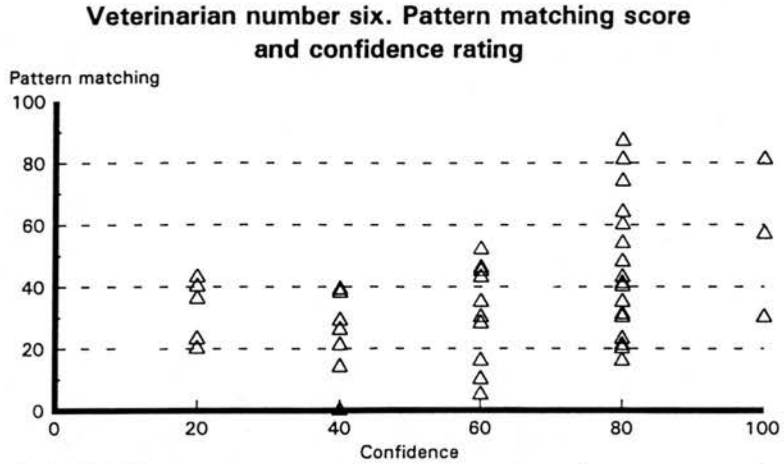

Fig 5.16 The pattern matching score against the confidence rating of the differential diagnoses of veterinarian number six

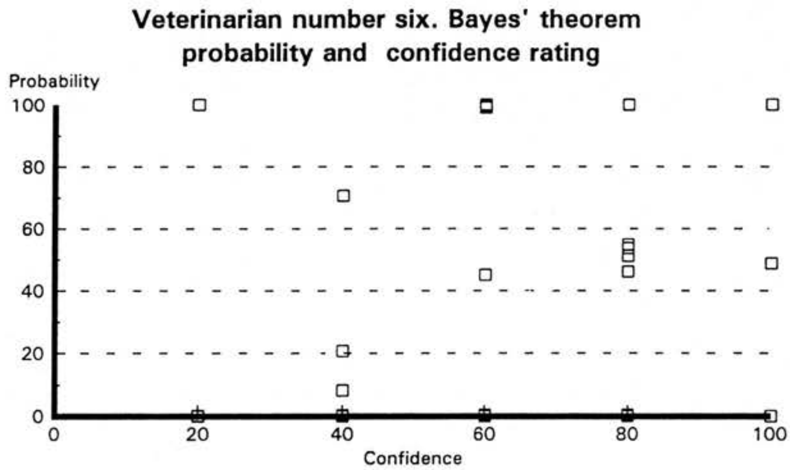

Fig 5.17 Bayes' theorem probability against the confidence rating of the differential diagnoses of veterinarian number six

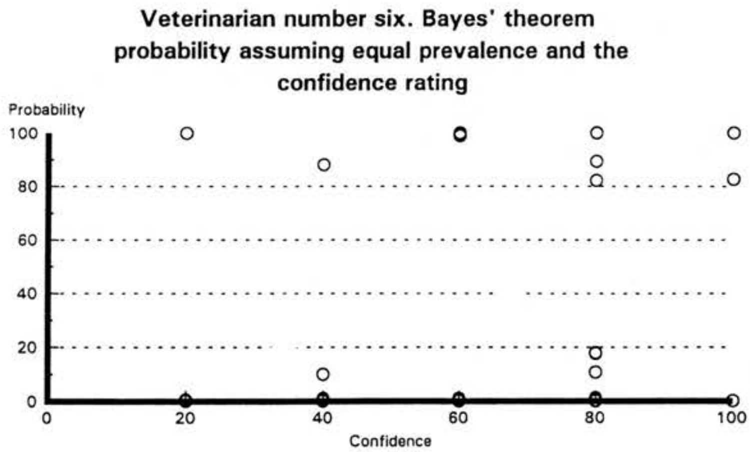

Fig 5.18 Probability assuming equal prevalence and the confidence rating of the differential diagnoses of veterinarian number six

The Shapiro-Francia statistic was calculated. The larger the value the better the conformity to a normal distribution with a maximum value of one for a perfect match (Statistix, 1992).

The results for the Wilk-Shapiro/Rankit plot are shown in table 5.04. The pattern matching score against the confidence rating produced the best measure of normality for each veterinarian within each category tested.

(iii) Pattern matching score means comparison

If the pattern matching model of pattern recognition was being used by the veterinarians with sufficient accuracy a significant difference between the confidence rating categories 20, 40, 60, 80 and 100 would be expected for the pattern matching profile scores in these categories.

The means of the pattern matching scores for the confidence categories 20, 40, 60,80 and 100 were compared for each veterinarian. A one way anova and the Bonferroni pair wise means comparison test was used (Statistix, 1992).

The means, standard deviations and statistical test results for the pattern matching scores within each confidence rating category are shown in table 5.05.

The means of the pattern matching scores within the confidence rating categories for Veterinarians V1 and V4 were significantly different for three categories in ascending order ($p<0.5$). The means of veterinarians V1, V2, V4, V5, and V6 were in ascending order according to the confidence rating categories and veterinarian V3 had three out of five means in ascending order according to the confidence rating categories. They were not significantly different.

Table 5.04 The Shapiro-francia statistic

Key PM Pattern matching
PB Probability
PB=Prev Probability assuming equal prevalence

		Confidence ratings				
Veterinarian		20	40	60	80	100
1	Number	39	43	25	8	1
	PM	0.8547	0.9107	0.9314	0.9010	-
	PB	0.1875	0.2440	0.6396	0.7343	-
	PB=Prev	0.3201	0.4439	0.7113	0.7834	-
2	Number	2	8	18	11	10
	PM	-	0.8676	0.8657	0.9717	0.9720
	PB	-	0.6997	0.4964	0.7442	0.6768
	PB=Prev	-	0.7247	0.5271	0.8169	0.7231
3	Number	6	20	22	9	5
	PM	0.8464	0.8512	0.9756	0.9566	0.7752
	PB	0.4684	0.5292	0.5528	0.5468	0.5781
	PB=Prev	0.4684	0.5508	0.7246	0.7125	0.7236
4	Number	5	21	28	12	2
	PM	0.9321	0.9213	0.9649	0.9287	-
	PB	0.6345	0.9213	0.7096	0.8941	
	PB=Prev	0.4728	0.3879	0.7212	0.8698	-
5	Number	1	7	12	22	0
	PM	-	0.9091	0.9450	0.9374	-
	PB	-	0.8136	0.8096	0.7164	-
	PB=Prev	-	0.8436	0.7410	0.7057	-
6	Number	5	9	11	18	3
	PM	0.9098	0.9012	0.9240	0.9657	-
	PB	0.5295	0.5126	0.7302	0.8024	-
	PB=Prev	0.5333	0.3930	0.6884	0.7497	-

Table 5.05 Statistical results for the pattern matching scores within each confidence category by veterinarian.

Key: Homogenous groups which are not significantly different are joined in the vertical axis by the symbol I.

Veterinarian 1

Confidence category	Mean	Sample size	Standard deviation
100	-	1	-
80	70.00	8	19.74
60	40.15	25	20.53
40	33.61	43	16.73
20	26.91	39	16.70

Bonferroni pair-wise comparison of means

Confidence category	Mean	Homogeneous groups
100	-	-
80	70.00	I
60	40.15	..I
40	33.15	..I
20	26.91	I

There are 3 groups in which the means are significantly different from one another. Rejection level 0.05.

Veterinarian 2

Confidence category	Mean	Sample size	Standard deviation
100	50.20	10	21.23
80	40.11	11	16.94
60	38.13	18	22.19
40	33.13	8	28.82
20	24.00	2	Sample too small

By Bonferroni pair-wise comparison of means there were no significant pair-wise differences among the means. Rejection level 0.05.

Veterinarian 3

Confidence category	Mean	Sample size	Standard deviation
100	49.20	5	5.85
80	57.89	9	24.27
60	37.30	22	21.12
40	35.15	20	17.47
20	33.17	6	19.45

By Bonferroni pair-wise comparison of means
were no significant pair-wise differences among the means.
Rejection level 0.05

Veterinarian 4

Confidence category	Mean	Sample size	Standard deviation
100	55.50	2	Sample too small
80	68.83	12	19.05
60	31.11	28	15.71
40	27.79	21	11.29
20	15.00	5	6.82

Bonferroni pair-wise comparison of means

Confidence category	Mean	Homogeneous groups
80	68.83	I
60	31.33	. I
40	27.79	. I
20	15.00	. . I

There are 3 groups in which the means are significantly different from one another.
Rejection level 0.05

Veterinarian 5

Confidence category	Mean	Sample size	Standard deviation
100	-	-	-
80	42.38	22	21.37
60	34.50	12	25.46
40	33.85	7	7.90
20	-	1	-

By Bonferroni pair-wise comparison of means there were no significant pair-wise differences among the means. Rejection level 0.05.

Veterinarian 6

Confidence category	Mean	Sample size	Standard deviation
100	56.00	3	Sample too small
80	46.22	18	21.70
60	32.27	11	15.98
40	25.80	9	11.90
20	32.40	5	10.31

By Bonferroni pair-wise comparison of means there were no significant pair-wise differences among the means. Critical Rejection level 0.05.

(iv) Partition of the confidence ratings

The values for the pattern matching scores, the probabilities and the probabilities assuming equal were grouped into intervals of <1, 1-10, 11-20, 21-30, 31-40, 41-50, 51-60, 61-70, 71-80, 81-90, and 91-100 within the confidence categories 20, 40, 60, 80 and 100 in which they had been placed by each veterinarian. This was to investigate the trends within the categories for these values.

Partition of the confidence rating according to the pattern matching model, Bayes' theorem probability and Bayes' theorem probability with equal prevalence are shown in table 5.06.

There was a normal clustering distribution within categories for pattern matching model. There was an upwards shift in the clustering across the confidence ratings from low to high. This pattern was repeated by all the veterinarians.

(v) Pattern recognition method analysis

The method that most accurately reflects the method of pattern recognition used by the veterinarians would have the most differential diagnoses correctly categorised (section 2.1(ii)) according to the equivalence intervals (table 2.04).

The number of correct categorisations by all the veterinarians within each category 20, 40, 60, 80 and 100 were compared according to the three models

A two times two contingency table test with Yates' correction factor was used to compare the accuracy of the partitions (Statistix, 1992).

Table 5.06 The partition of the confidence rating by pattern matching, probability and probability with equal disease prevalence.

Veterinarian 1

	Confidence rating														
	Pattern matching					Probability					Probability equal prevalence				
Interval	100	80	60	40	20	100	80	60	40	20	100	80	60	40	20
<1	-	-	-	-	-	-	-	16	34	35	-	1	18	34	37
1-10	-	-	1	1	1	-	1	2	7	3	-	-	2	3	2
11-20	-	-	4	6	15	-	1	-	1	-	-	1	-	1	-
21-30	-	-	2	12	12	-	-	-	1	-	-	-	-	-	-
31-40	-	-	2	11	3	-	-	1	-	-	-	-	-	-	-
41-50	-	2	8	4	3	-	-	-	-	-	-	-	-	-	-
51-60	-	1	1	4	3	-	-	-	-	-	-	-	-	1	-
61-70	-	1	3	3	1	-	-	-	-	-	-	1	-	2	-
71-80	-	1	2	1	-	-	-	-	-	-	-	-	-	-	-
81-90	-	3	3	-	-	-	-	1	-	-	-	-	1	-	-
91-100	1	1	-	-	-	1	6	5	-	1	1	5	3	2	-
Totals	1	8	25	43	39	1	8	25	43	39	1	8	25	43	39

Veterinarian 2

	Confidence rating														
	Pattern matching					Probability					Probability equal Prevalence				
Interval	100	80	60	40	20	100	80	60	40	20	100	80	60	40	20
<1	-	-	-	-	-	3	5	13	5	2	2	4	13	5	2
1-10	-	-	3	1	-	-	-	1	-	-	1	-	1	-	-
11-20	1	1	4	1	1	-	1	-	-	-	-	1	-	-	-
21-30	2	3	3	2	-	-	1	2	-	-	-	1	1	-	-
31-40	-	1	3	2	1	-	-	-	-	-	-	-	-	-	-
41-50	2	4	3	-	-	-	-	-	-	-	-	1	-	-	-
51-60	2	-	-	1	-	-	-	-	-	-	-	-	-	1	-
61-70	1	2	-	-	-	-	-	-	-	-	-	-	1	-	-
71-80	2	-	1	-	-	1	-	-	-	-	1	-	-	-	-
81-90	-	-	1	-	-	-	-	-	1	-	1	-	-	-	-
91-100	-	-	-	1	-	6	4	2	2	-	5	4	2	2	-
Totals	10	11	18	8	2	10	11	18	8	2	10	11	18	8	2

Veterinarian 3

Confidence rating

Interval	Pattern matching 100	80	60	40	20	Probability 100	80	60	40	20	Probability equal prevalence 100	80	60	40	20
<1	-	-	-	-	-	-	2	15	15	5	-	1	11	14	5
1-10	-	-	2	-	-	-	-	2	1	1	-	-	5	2	1
11-20	-	1	3	3	2	-	-	1	-	-	-	-	2	-	-
21-30	-	-	4	8	2	-	-	1	-	-	-	1	-	-	-
31-40	-	-	5	3	1	-	-	1	-	-	-	-	2	-	-
41-50	3	3	2	4	-	-	-	1	-	-	-	-	1	-	-
51-60	2	-	1	-	-	-	-	-	1	-	-	-	-	-	-
61-70	-	2	4	1	1	1	-	-	-	-	1	-	1	1	-
71-80	-	2	1	-	-	-	-	-	-	-	-	-	-	1	-
81-90	-	-	-	1	-	-	-	1	-	-	1	-	-	-	-
91-100	-	1	-	-	-	4	7	-	3	-	3	7	-	2	-
Totals	5	9	22	20	6	5	9	22	20	6	5	9	22	20	6

Veterinarian 4

Confidence rating

Interval	Pattern matching 100	80	60	40	20	Probability 100	80	60	40	20	Probability equal prevalence 100	80	60	40	20
<1	-	-	-	-	-	-	2	19	17	-	-	-	15	17	5
1-10	-	-	2	-	2	-	2	-	-	1	-	2	4	-	-
11-20	-	-	6	5	1	-	-	1	1	2	-	2	1	1	-
21-30	-	-	9	11	2	-	1	-	2	2	-	2	-	2	-
31-40	-	1	1	2	-	-	-	1	-	-	-	-	1	-	-
41-50	-	2	7	2	-	-	1	2	-	-	-	-	1	-	-
51-60	2	-	2	1	-	-	1	-	-	-	-	-	1	-	-
61-70	-	2	1	-	-	-	1	-	-	-	-	-	-	-	-
71-80	-	3	-	-	-	-	-	-	-	-	-	2	1	-	-
81-90	-	3	-	-	-	-	-	2	-	-	-	2	-	-	-
91-100	-	1	-	-	-	2	4	3	1	-	-	2	4	1	-
Totals	2	12	28	21	5	2	12	28	21	5	2	12	28	21	5

Veterinarian 5

Confidence rating

	Pattern matching					Probability					Probability equal prevalence				
	100	80	60	40	20	100	80	60	40	20	100	80	60	40	20
Interval															
<1	-	-	-	-	-	-	8	5	4	1	-	9	4	4	1
1-10	-	1	2	-	-	-	1	1	-	-	-	1	2	-	-
11-20	-	3	3	1	-	-	-	1	-	-	-	-	-	-	-
21-30	-	4	1	2	-	-	-	-	2	-	-	-	1	-	-
31-40	-	4	1	3	-	-	1	-	-	-	-	1	-	2	-
41-50	-	4	2	1	1	-	-	-	-	-	-	-	-	-	-
51-60	-	2	1	-	-	-	-	-	-	-	-	-	-	-	-
61-70	-	2	-	-	-	-	-	1	1	-	-	-	-	1	-
71-80	-	1	2	-	-	-	1	1	-	-	-	-	-	-	-
81-90	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
91-100	-	1	-	-	-	-	11	3	-	-	-	11	4	-	-
Totals	0	22	12	7	1	0	22	12	7	1	0	22	12	7	1

Veterinarian 6

Confidence rating

	Pattern matching					Probability					Probability equal prevalence				
	100	80	60	40	20	100	80	60	40	20	100	80	60	40	20
Interval															
<1	-	-	-	-	-	1	7	6	6	4	1	6	6	7	4
1-10	-	-	2	-	-	-	-	-	1	-	-	2	-	-	-
11-20	-	3	1	1	1	-	-	-	1	-	-	2	-	-	-
21-30	1	2	2	5	1	-	-	-	-	-	-	-	-	-	-
31-40	-	3	1	3	2	-	-	-	-	-	-	-	-	-	-
41-50	-	3	4	-	1	1	1	1	-	-	-	-	1	-	-
51-60	1	2	1	-	-	-	3	-	-	-	-	-	-	-	-
61-70	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-
71-80	-	1	-	-	-	-	-	-	1	-	-	-	-	-	-
81-90	1	2	-	-	-	-	-	-	-	-	1	2	-	1	-
91-10	-	-	-	-	-	1	7	4	-	1	1	6	4	-	1
Totals	3	18	11	9	5	3	18	11	9	5	3	18	11	9	5

The statistical analyses are shown in tables 5.07 to 5.10. There was a statistically significant ($p < 0.05$) greater number of correct categorisations with the pattern matching model when compared to either the probability model or the probability with equal prevalence model for each the veterinarians, except for veterinarian V2. There was no significant difference in the case of veterinarian V2.

Across all the veterinarians the correct categorisation was achieved in 42.8 percent (164/383) of the differential diagnoses with the pattern matching model , 9.1 percent (35/383) with the probability model and 7.3 percent (28/383) with the probability with equal prevalence model. In each confidence rating category there was a significant increase ($p<0.05$) in the number of correct categorisations for the pattern matching model when compared to the probability partition and the probability with equal prevalence partition across all the categories except for the confidence rating category 100. In category 100 there was a significant increase in the correct categorisations by the probability methods ($p<0.05$).

(vi) The difference by category between the confidence ratings and the pattern matching scores

The difference by category (2.1 (iii)) between the veterinarian confidence rating score and the pattern matching score was computed for each veterinarian. This is a measure of the pattern matching abilities of the veterinarians. The experience of the veterinarians and their mean deviations by category from the pattern matching scores were compared using a Spearman rank correlation (Statistix, 1992).

A histogram of the deviations by category of the veterinarian confidence ratings from the pattern matching scores is shown in figure 5.19. Table 5.11 presents the

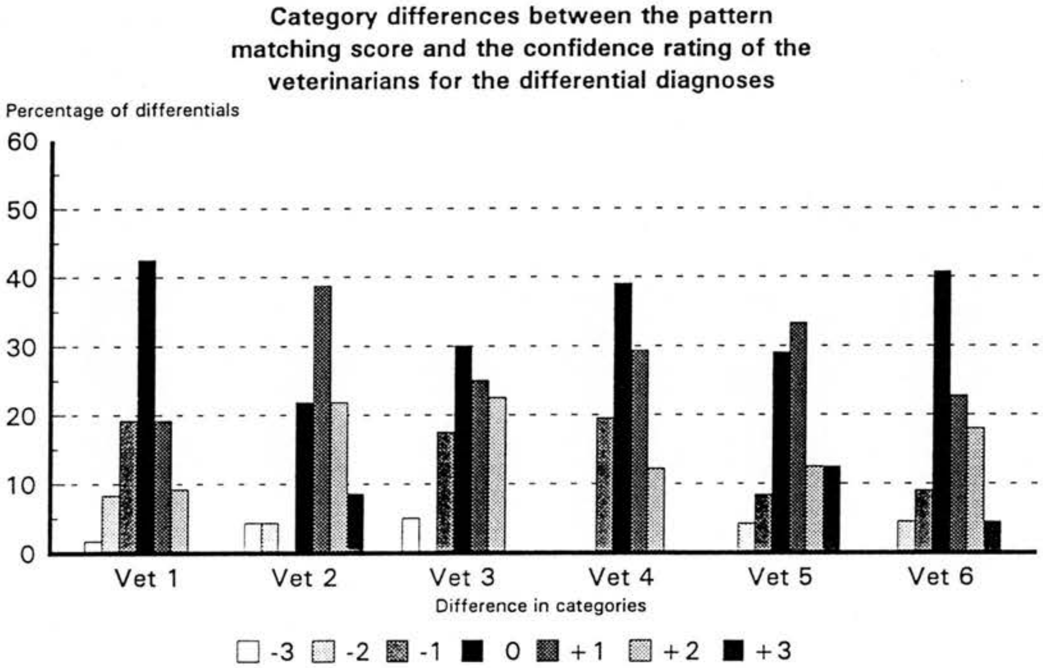

Fig 5.19 The percentage of differentials against the category differences between the confidence rating and pattern matching score

Table 5.07 Two times two contingency table analysis of pattern matching scores and probabilities for all categories

Veterinarian	Pattern matching Correct/total (% correct)	Probability Correct/total (% correct)	Yates Chi sq p value
1	53/116 (46)	5/116 (4)	0.0000
2	10/49 (20)	6/49 (12)	0.4123
3	20/62 (32)	6/62 (10)	0.0001
4	32/68 (47)	10/68 (15)	0.0001
5	11/42 (26)	3/42 (7)	0.0404
6	18/46 (39)	5/46 (11)	0.0039

Table 5.08 Two times two contingency table analysis of pattern matching scores and equal prevalence probabilities for all categories

Veterinarian	Pattern matching Correct/total (% correct)	Probability equal prevalence Correct/total (% correct)	Yates Chi sq p value
1	53/116 (46)	4/116 (3)	0.0000
2	10/49 (20)	7/49 (14)	0.5900
3	20/62 (32)	6/62 (10)	0.0054
4	32/68 (47)	5/68 (7)	0.0000
5	11/42 (26)	3/42 (7)	0.0450
6	18/46 (39)	3/46 (7)	0.0005

Table 5.09 Two times two contingency table analysis of pattern matching scores and probabilities within categories for all the veterinarians

	Categories				
	20	40	60	80	100
Pattern matching Correct\total	23/58	84/108	35/116	18/80	4/21
% correct	40	59	30	23	19
Probability Correct\total	10/58	6/108	3/116	2/80	14/21
% correct	17	6	3	3	67
P-value for Yates Chi-sq correction	0.0135	0.0000	0.0000	0.0003	0.0005

Table 5.10 Two times two contingency table analysis of pattern matching scores and probabilities with equal prevalence within categories for all the veterinarians

	Categories				
	20	40	60	80	100
Pattern matching Correct/total	23/58	84/108	35/116	18/80	4/21
% correct	40	59	30	23	19
Probability equal prevalence					
Correct/total	3/58	5/108	6/116	1/80	13/21
% correct	5	5	5	1	62
P-value for Yates Chi-sq correction	0.0000	0.0000	0.0000	0.0000	0.0119

means and the standard deviations. There was a Spearman rank correlation of 0.8286 between the experience of the veterinarians and their mean deviations by category from the pattern matching scores.

(vii) The difference by category between the confidence ratings of the veterinarians

Veterinarian one had the greatest experience and was chosen for comparative purposes. The differential diagnoses which each veterinarian had in common with veterinarian one within each case report were used.

The difference by category between the confidence rating of veterinarian number one and each veterinarians two to six was computed. A two sample two tailed t-test was performed (Statistix, 1992).

The difference by category in confidence rating between veterinarian V1 and the veterinarians V2 to V6 are shown in table 5.12. The means and standard deviations are presented. There was no significant difference between the means of veterinarian V1 and V5 ($p<0.05$). The means of veterinarians V2, V3 , V4 and V6 were each significantly different from the means of veterinarian V1 ($p<0.05$).

(viii) Analysis of alternative methods of pattern recognition

The differential diagnoses which each veterinarian had in common with veterinarian one within each case report were used.

If an alternative method of pattern recognition was being used by the veterinarians there may be greater agreement between veterinarians than between the model and the veterinarians.

Table 5.11 The deviation by category of the confidence rating of the veterinarians from the pattern matching score for the differential diagnoses

Deviation	Veterinarians					
	Vet 2	Vet 3	Vet 4	Vet 5	Vet 6	Vet 1
-3	1	2	0	0	0	2
-2	1	0	0	1	1	10
-1	0	7	8	2	2	23
0	5	12	16	7	9	51
+1	9	10	12	8	5	23
+2	5	9	5	3	4	11
+3	2	0	0	3	1	0
Total	23	40	41	24	22	120
Mean	0.87	0.41	0.34	0.79	0.55	-0.03
S.d.	1.39	1.30	0.93	1.28	1.18	1.12

Table 5.12 The deviation by category of the confidence rating between Veterinarian one and veterinarians two to six for the differential diagnoses

Deviat-ion	Veterinarians				
	Vet 2	Vet 3	Vet 4	Vet 5	Vet 6
-2	0	0	1	2	0
-1	3	7	5	2	2
0	5	18	17	9	8
+1	6	10	12	7	11
+2	7	5	6	3	0
+3	1	0	0	1	1
Total	23	40	41	24	22
Mean	0.91	0.33	0.41	0.42	0.55
S.d.	1.15	0.91	0.97	1.21	0.85

The mean of the deviations from the pattern matching score of the veterinarian was compared to the mean of the deviations from veterinarian number one. This was performed for veterinarians two to six. A two tailed two sample t-test was performed (Statistix, 1992).

There was no significant difference ($p<0.05$) between the means of the deviations from the pattern matching scores and the means of the deviations from veterinarian V1 for veterinarians V2 to V6.

(ix) Differential diagnosis ranking analysis

If the veterinarians use pattern matching and they can apply it accurately, then a high rank correlation between the confidence rating and the pattern matching score for each veterinarian within cases would be expected, e.g if diseases A,B and C were placed 1,2 and 3 by rank using the pattern matching score the same rank would be expected if the veterinarians were using the same method accurately.

The rankings by the veterinarians of the differential diagnoses by the confidence ratings and by the pattern matching score within cases were compared. A Spearman rank correlation test was used (Statistix, 1992).

The results of the comparison of the rankings of the differential diagnosis by the confidence ratings and by the pattern matching scores are shown in table 5.13. There was a wide variation in the level of correlation.The correlation by rank of the veterinarian confidence ratings and the pattern matching scores within cases was low.

The accuracy of the pattern matching ability was too low to be strongly reflected in the rank correlation analysis.

Table 5.13 Spearman rank coefficient for the veterinarian confidence ratings and the pattern matching scores within cases.

	Veterinarians					
Case	V1	V2	V3	V4	V5	V6
1	0.30	0.40	0.35	0.76	0.50	-0.89
3	0.03	-	-0.80	0.89	0.01	0.87
4	0.73	0.22	0.95	0.87	0.87	0.00
5	0.32	0.63	0.50	-	-	0.00
6	-0.20	0.21	0.53	0.00	-	0.00
7	0.66	0.77	0.21	0.77	0.87	0.21
8	-0.06	0.50	0.44	0.32	-	0.87
9	0.53	-	0.77	1.00	-	-
10	0.09	-	0.74	0.00	-	-
11	0.78	0.50	0.71	-	-	-
12	0.63	-	-	-0.71	-	-
13	0.96	-	0.87	-	-	-
14	-0.05	0.50	0.63	-0.43	-0.04	-0.87
16	1.00	-	0.77	0.16	-0.89	-0.77
18	-	1.00	-	0.16	-	0.50

5.3.2 Recall and ranking analysis

The veterinarian confidence ratings, the Bovid probabilities and the hypothetico-deductive pattern matching model's pattern matching scores of the case report diagnoses are presented in table 5.14.

(i) Ranking

The number of the case report diseases ranked the highest and not ranked out of the 18 case reports presented are shown in figure 5.20.

The veterinarians placed 62 percent (67/108) of the case reports in the highest rank. The mean number of cases in the heighest rank was 11.17 (range 6-14) cases. The pattern matching model ranked 72 percent (13/18) of the case report diseases in the highest rank. Bovid ranked 61 percent (11/18) of the case report diseases in the highest rank. A two times two contingency table test with the Yates' correction factor was used (Statistix, 1992). The pattern matching model placed significantly more of the case reports in the highest rank than the veterinarians ($p<0.05$).

The veterinarians did not rank 27 percent (29/108) of the case reports in the differential diagnoses. The mean number of cases not ranked for the veterinarians was 4.80 (1-9) cases. The pattern matching model listed all the case report diagnoses in the differential. Bovid did not rank 17 percent (3/18) of the case report diagnoses. The veterinarians were compared to bovid and to the pattern matching model using a two times two contingency table test using the Yates' correction factor (Statistix, 1992). The veterinarians left out significantly more of the case report diseases than the pattern matching model and the probability model ($p<0.05$).

Table 5.14 Confidence ratings by the veterinarians, probabilities and pattern matching scores of the case reports.

Case	**Confidence ratings of the case reports diseases by the veterinarians.** [] Number of differentials in the confidence rating or greater. * Highest rating on the differential diagnosis list. NR Diagnosis was not included in the differential diagnoses						Proba-bility (Rank)	Pro-file score (Rank)
	1	2	3	4	5	6		
1	NR	NR	NR	NR	NR	NR	0	37 (5)
2	80 [2] *	100 [1] *	100 [1] *	60 [1] *	80 [1] *	80 [1] *	100 (1)	62 (1)
3	60 [3]	100 [1] *	NR	80 [2] *	NR	80 [2] *	99 (1)	81 (1)
4	80 [1] *	60 [2] *	60 [3] *	NR	60 [4]	NR	100 (1)	37 (2)
5	20 [2]	NR	40 [3]	NR	NR	NR	0	43 (9)
6	80 [2] *	80 [1]	40 [4]	80 [3] *	NR	80 [5]	90 (1)	39 (1)
7	80 [1] *	100 [1] *	80 [1] *	60 [4]	80 [1] *	80 [2] *	100 (1)	48 (1)
8	80 [1] *	NR	80 [1] *	80 [1] *	80 [2] *	80 [2]	33 (1)	41 (1)

Case	Confidence ratings of the case reports diseases by the veterinarians. [] Number of differentials in the confidence rating or greater. * Highest rating on the differential diagnosis list. NR Diagnosis was not included in the differential diagnoses						Probability (Rank)	Profile score (Rank)
	1	2	3	4	5	6		
9	60 [1] *	100 [1] *	80 [1] *	80 [1] *	80 [1] *	NR	25 (2)	71 (1)
10	60 [1] *	NR	60 [2] *	60 [4] *	NR	NR	0	55 (1)
11	40 [8]	80 [1] *	60 [4]	80 [4] *	NR	NR	16 (2)	67 (8)
12	60 [1] *	100 [1] *	100 [1] *	NR	80 [1] *	60 [3] *	82 (1)	50 (1)
13	80 [2] *	40 [3]	80 [1] *	80 [2] *	80 [1] *	NR	92 (1)	98 (1)
14	60 [2] *	60 [3] *	100 [1]	40 [10] *	NR	60 [3]	1 (3)	45 (1)
15	100 [1] *	100 [1] *	100 [1] *	100 [1] *	80 [1] *	80 [1] *	91 (1)	54 (1)
16	80 [1] *	NR	80 [1] *	3 [2] *	NR	NR	100 (1)	68 (1)
17	80 [1] *	100 [1] *	100 [1] *	100 [1] *	80 [1] *	100 [1] *	100 (1)	57 (1)

Case	**Confidence ratings of the case reports diseases by the veterinarians.** [] Number of differentials in the confidence rating or greater. * Highest rating on the differential diagnosis list. NR Diagnosis was not included in the differential diagnoses						Probability (Rank)	Profile score (Rank)
	1	2	3	4	5	6		
18	3 [1] *	2 [1] *	100 [1] *	60 [2] *	NR	NR	3 (9)	45 (2)

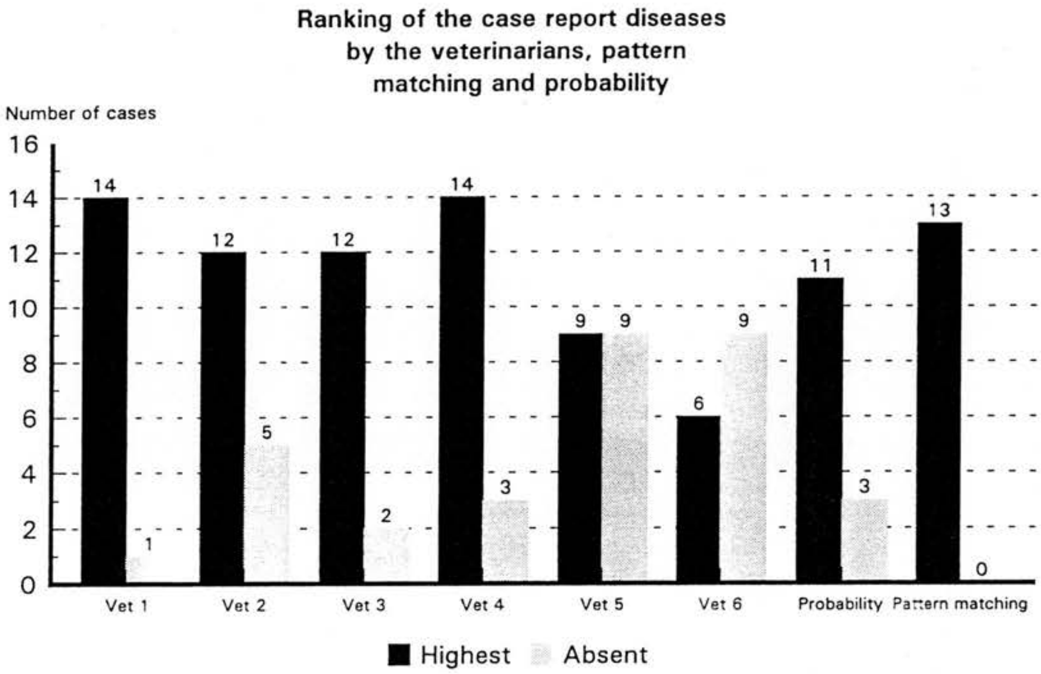

Fig 5.20 Number of the case report diseases given the highest rank or absent from the differential diagnosis lists

(ii) Recall

The number of differential diagnoses and their means are listed by veterinarian for each case and are presented in table 5.15. The mean for all the veterinarians was 3.5 differential diagnoses *per* case. The number of different diseases recalled by the veterinarians are shown in table 5.15. A mean of 11.6 different diseases *per* case were recalled by the veterinarians.

The number of veterinarians that recalled the same disease within a case is shown in table 5.16. The results expressed as percentages are presented in figure 5.21. The same disease was recalled by all 6 veterinarians for the same case on 5 occasions. This represents 2.4% of the differential diagnoses recalled. Fifty nine percent of the differential diagnoses were supported by a single veterinarian (1/6).

To examine the relationship between the number of case differential diagnoses recalled and the number of correct diagnoses a Spearmen rank correlation was computed for the veterinarians (Statistix, 1992).

There was a Spearman rank correlation of 0.97 between the number of differential diagnoses recalled by the veterinarians and the number of case reports ranked as the leading hypothesis by the veterinarians.

5.3.3 Database accuracy

The absence and presence of the case report attributes in Bovids' database are shown in table 5.17. The Bovid database descriptions of the case report diseases had a mean of 2.39 attributes missing.

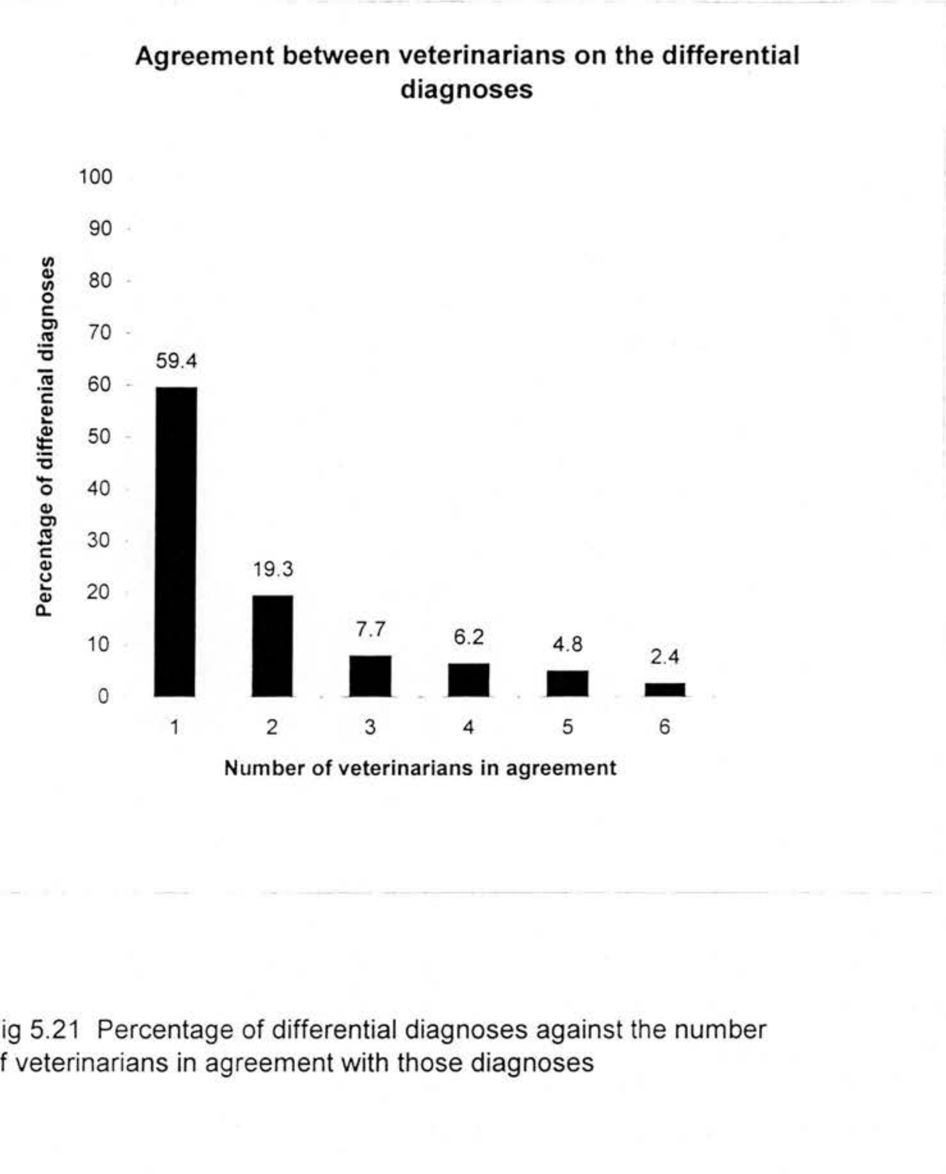

Fig 5.21 Percentage of differential diagnoses against the number of veterinarians in agreement with those diagnoses

Table 5.15 The number of differential diagnoses listed by the veterinarians for each case and the total number of different diseases listed for each case across all the veterinarians.

Cases	Veterinarian Differential Diagnoses						Case Total	Different Diseases
	1	2	3	4	5	6		
1	22	3	5	7	2	3	43	23
2	1	2	1	3	2	5	14	6
3	7	2	5	3	2	2	21	11
4	8	4	6	3	3	3	27	16
5	7	3	2	2	2	2	18	9
6	8	4	5	3	2	5	27	17
7	6	4	4	4	3	4	25	12
8	7	3	4	4	4	2	24	15
9	10	2	3	3	1	1	20	15
10	5	2	4	5	2	2	20	13
11	8	3	5	3	1	1	21	10
12	4	2	1	5	1	2	15	11
13	5	2	3	3	1	2	16	6
14	10	3	4	10	8	3	38	18
15	1	2	2	1	1	1	8	3
16	3	2	4	6	4	4	23	11
17	2	2	2	1	1	1	9	3
18	2	3	2	3	1	3	14	10
Totals	116	48	62	69	42	46	383	209
Mean	6.4	2.7	3.4	3.8	2.3	2.6	3.5	11.6

Table 5.16 Agreement between veterinarians on the differential diagnoses within cases.

Case	The number of veterinarians in agreement						Total
	1	2	3	4	5	6	
1	14	3	2	3	1	0	43
2	1	2	1	0	0	1	14
3	4	5	1	1	0	0	21
4	10	3	2	0	1	0	27
5	6	1	0	1	0	1	18
6	11	2	1	1	1	0	27
7	7	2	1	0	1	1	25
8	10	3	1	0	1	0	24
9	13	1	0	0	1	0	20
10	8	3	2	0	0	0	20
11	6	1	0	2	1	0	21
12	10	0	0	0	1	0	15
13	1	3	0	1	1	0	16
14	8	4	3	2	1	0	38
15	2	0	0	0	0	1	8
16	3	5	2	1	0	0	23
17	1	1	0	0	0	1	9
18	8	1	0	1	0	0	14
Totals	123	40	16	13	10	5	383

Table 5.17 The absence and presence of the case report attributes in Bovid's database

Case report	Attributes absent	Attributes present
1	3	4
2	4	14
3	0	6
4	5	9
5	4	10
6	5	11
7	4	14
8	2	7
9	0	6
10	4	8
11	1	4
12	1	5
13	0	4
14	3	7
15	2	10
16	0	5
17	4	10
18	1	6

5.4 Discussion

5.4.1 Pattern recognition

The results of the veterinarians most closely resembled the pattern matching model at all experience levels when compared to Bayes' theorem probabilities with conditional independence. The most experienced veterinarian had the most accurate pattern matching ability.

Gorry (1973) has stated that clinicians recognise levels of belief or certainty but they do not routinely quantitate or use these certainty concepts in any formal statistical manner. In this study the veterinarians were asked to express their belief in a diagnosis in terms of their confidence in a differential diagnosis being the diagnosis. This certainty or belief system was found to be closely related to the pattern matching model.

Pattern matching ability was correlated with experience. This observation is consistent with other workers who found that pattern matching in the form of template comparisons is a major factor in pattern recognition and that the ability is a function of experience (Rogers *et al*, 1979; Barrows and Bennett, 1972; Kassirer *et al*, 1982; Elstein *et al*, 1978). The pattern matching of all the veterinarians was sub-optimal in comparison to the pattern matching model.

Veterinarian one and the pattern matching model were compared to the other veterinarians to check for a disguised pattern recognition method. There was no evidence to suggest this was the case.

The correlation by rank of the veterinarian confidence ratings and the pattern matching profile scores was low within cases. Pattern matching ability may be related to the degree of similarity in profile between the test profile and the prototype template.

The pattern recognition method used by the pattern matching model is a much simpler although not necessarily more accurate means of pattern recognition than Bayes' theorem probabilities. For human implementation disease profiles and simple categories of prevalence would need to be memorised. The processing of new data does not require a complete recalculation of all the profiles but a simple comparison with the disease profiles in memory. It may be less accurate than a probability model but it is probably more understandable, familiar and acceptable. It is also supported by the current teaching methods. A comparison of pattern matching and Bayes' theorem probabilities in clinical reasoning has been reviewed in the introduction.

The use of point prevalence frequencies as an ideal type description of diseases refutes the statement by Pollock (1985a) that all findings be given equal weighting as no alternative method exists to standardise the designation of weighting.

5.4.2 Recall and Diagnosis

There was a higher probability of the diagnosis being in the differential diagnosis list if a greater number of appropriate differential diagnoses were recalled from memory. Veterinarians who recalled a higher number of differential diagnoses when presented with a clinical case report had more correct diagnoses. The most experienced veterinarian in this study generated the greatest number of differential diagnoses but the correlation in relation to experience was low. Barrows *et al* (1978) found that the number of hypotheses generated were unrelated to either the successful diagnostic outcome or to the level of clinical experience .

The failure to generate and consider relevant diagnostic hypotheses is recognised as the most prevalent cause of incorrect diagnosis (Dowie and Elstein, 1988; Detmer, 1978; Elstein et al, 1978). This study supports this observation. Thirty eight percent of the case report diagnoses were not identified as the diagnosis by the veterinarians, 71 percent of these cases were not included on the differential diagnosis list. If the disease is recalled from memory the diagnostic accuracy is high at 85 percent. Veterinarians tend to make the correct diagnosis provided the disease is recalled from memory. This agrees with observations made in human medicine (Young, 1980).

The number of hypotheses generated was in general agreement with the number of hypotheses that can be considered together (Pollock, 1985; Blois 1980, Elstein *et al*, 1978). Veterinarians may subconsciously limit the differential diagnoses to a number they can actually consider at one time. This may lead to errors in diagnostic accuracy as any differential excluded from the list at this stage may not be reconsidered (Fischoff, 1983; Morely, 1991; Fessler, 1984b). Decision support systems can consider unlimited numbers of competing hypotheses and may provide an advantage in this regard.

The level of inter-observer agreement on which differential diagnoses were to be included in the list of differential diagnoses was low. This inconsistency may be related to recall ability, pattern matching ability and the quality of the library of disease descriptions in the memory.

5.4.3 Ranking and diagnosis

The diagnostic accuracy of an algorithm is usually expressed as the percentage ratio of the correct diagnosis to attempted diagnosis. It is more meaningful to compare the performance with the clinicians (Rogers et al, 1979).

In an evaluation study of human clinicians using published case reports the diagnostic accuracy over 42 cases was 65 percent correct (Miller *et al*, 1982). This is similar to the diagnostic accuracy recorded in the study.

The pattern matching model was significantly better than the veterinarians at placing the diagnosis in the top rank and including the diagnosis in the differential diagnosis list. The pattern matching model was an accurate method of pattern recognition. The case report diseases were most closely matched to their ideal type for comparative purposes on 13 out of 18 occasions.

If however, the model is presented with disease profiles that are atypical or do not conform to their prototype descriptions then the profile match will be poor. Testing different case presentations for each disease should be a topic for further research.

5.4.4 Database quality

The source of the information for the database whether in memory or computer is of major importance since its accuracy has a direct influence on the accuracy of the diagnostic system itself (Rogers *et al*, 1979). It has been reported that databases generated from medical records may produce more accurate diagnoses than those generated from the opinions and estimates of clinicians (Birk et al, 1974, Leaper et al, 1972). The database used was generated from the estimates and opinions of a panel of veterinarians.

The number of signs presented in the case reports but that were missing from the database descriptions of the case report diseases confirm that the database was imperfect or that some of the case report descriptions were atypical.

Chapter 6

Bovine Spongiform Encephalopathy Differential Diagnosis Pattern Matching Models

6.1 Introduction

Bovine Spongiform Encephalopathy (B.S.E) is a fatal disease of cattle and was identified as a new disease in 1986 (Wells *et al*, 1986). The clinical diagnosis of B.S.E is based upon the clinical signs observed and the history of the case. There is no acceptable clinical test to detect B.S.E.. The diagnosis of B.S.E is confirmed by histopathology using brain sections (Wells *et al*, 1986). Histopathology has a specificity and sensitivity of up to 99% with a highly consistent repeatability (Wells *et al*, 1989).

The disease was made notifiable in 1988 (Taylor, 1991). When a suspect case is reported the animal is examined by a MAFF veterinarian and questionnaire is completed which contains a check list of the clinical signs observed (Wilesmith *et al*, 1992). There have been 159,122 confirmed cases up to March 1996 (Whitaker, 1996). The purpose of this chapter is to describe four pattern matching models for the differential diagnosis of B.S.E which will be used in chapter seven and eight to investigate pattern matching as a pattern recognition method for the diagnosis of B.S.E..

Chapters two and four has shown that pattern matching is a method of pattern recognition used by veterinarians. The pattern matching models described in this chapter are used in chapter seven to investigate their ability to identify prototype disease profiles contained within the database . In chapter eight the models are used to investigates the ability of the pattern matching models to identify confirmed B.S.E case reports.

6.2 Materials and methods

The disease profiles and sign frequencies for all the conditions in the database except B.S.E were compiled from Bovid version 2 (Blood *et al*, 1989). The check list used in the program and the B.S.E. sign frequencies were adapted from Wilesmith *et al* (1992). The models were written in turbo-Pascal and a copy of the program with installation instructions can be found in the back of the thesis. The program used models 1-4 and which are described in chapter four. The database used in the program is given in appendix 4.

What the program does

The operator enters the clinical signs which were observed to be present from the list of 14 clinical signs below.

Fourteen sign check list:

1. Abnormal head and/or ear position
2. Apprehension and/or nervous
3. Apparent blindness
4. Circling
5. Exaggerated responses
6. Falling
7. Frenzy
8. Head pressing
9. Kicking in the parlour
10. Licking or/and biting
11. Muscle tremors
12. Sick more than 2 weeks or more
13. Staggering and/or ataxia
14. Weight loss

Conditions in the database have one or more of the clinical signs present in their sign profiles. There is a total of 55 conditions in the database. The database contains the sign frequencies for the 14 sign check list. The frequencies are given for each of the conditions in the database. B.S.E is given as an example in table 6.01. In a 100 cases of B.S.E. 1 case would show circling and 99 would not.

The conditions in the database are marked according to their relative prevalence:

Condition prevalence

* * * = Common
* * = Encountered fairly frequently
* = Occasionally seen
Rare

Assume the following signs were observed to be present in a case after checking the 14 signs in the check list above. These are entered into the program.

Check list signs observed to be present

1. Abnormal head/ear position
2. Apprehension/nervous
5. Exaggerated responses
9. Kicking in parlour
11. Muscle tremors
12. Sick 2 weeks or more
13. Staggering/difficulty walking
14. Weight loss

The input data is analyzed using 4 pattern matching models:

Table 6.01 Sign frequencies in B.S.E.

		Present %	Absent %
1.	Abnormal head and/or ear position	65	35
2.	Apprehension and/or nervous	85	15
3.	Apparent blindness	1	99
4.	Circling	1	99
5.	Exaggerated responses	80	20
6.	Falling	35	65
7.	Frenzy	30	70
8.	Head pressing	16	84
9.	Kicking in the parlour	50	50
10.	Licking or/and biting	45	55
11.	Muscle tremors	70	30
12.	Sick more than 2 weeks or more	95	5
13.	Staggering and/or ataxia	80	20
14.	Weight loss	80	20

6.3 Results

6.3.1 Pattern Matching: Model 1

The sign frequencies for the above **signs observed to be present** for each condition in the database are summated and arranged in descending order of magnitude.

Rank		Condition	Sum of sign frequencies
1	* * *	B.S.E	605
2	* * *	Hypomagnesaemia	415
3	* * *	Milk fever	360
4		Hemlock	340
5	*	Tetanus	320
6		Oxalate	290
7		Arsenic	275
8	* *	Acute lead	265
9		Mercury	265
10		Brain tumour	245

6.3.2 Pattern Matching: Model 2

Sum of the sign frequencies of the check list signs present with LOGICAL EXCLUSION. Conditions are excluded if a sign is observed which is never seen in that condition or a sign is absent which should always be present.

Rank		Condition	Sum of sign frequencies
1	* * *	B.S.E	605

6.3.3 Pattern Matching: Model 3

The sign frequencies for the above signs **observed to be present and those signs on the list observed to be absent** for each condition in the database are summated and arranged in descending order of magnitude.

Rank		Condition	Sum of sign frequencies
1	* * *	B.S.E	1077
2	* * *	Hypomagnesaemia	980
3		Hemlock	940
4	* * *	Milk fever	920
5	*	Tetanus	870
6		Arsenic	855
7		Oxalate	850
8		BVL	835
9	*	Black leg	825
10		Organochloride	810

6.3.4 Pattern Matching: Model 4

Sum of the sign frequencies of the check list signs absent and present with logical exclusion.

Rank		Condition	Sum of sign frequencies
1	* * *	B.S.E	1077

6.4 Discussion

These models do not combine prevalence and disease profile data but present the information separately providing information rather than a diagnosis to the veterinarian in a decision support system. Models 2 and 4 assume that clinical abnormalities entered are completely reliable as they utilise logical exclusion. Models 1 and 3 assume that the data entered may be unreliable and do not use logical exclusion. Data reliability is dependent upon the observations of abnormalities being accurate.

Chapter 7
B.S.E. Database Prototype Profiles

7.1 Introduction

The B.S.E pattern matching models have prototype disease descriptions in their database. The prototype descriptions are the point prevalence frequencies of the clinical signs of the diseases. Pattern matching is by template comparisons which assumes that diseases conform to their prototypes. This experiment was designed to investigate if the prototypes within the B.S.E database are unique. If the prototype profile of disease A is entered will the system identify the profile as disease A?. This is a measure of the database accuracy.

7.2 Materials and methods

The system allows the operator to enter signs observed from the 14 sign checklist. The best descriptions of the prototype profiles contained within the database that can be entered are the signs within a disease that have a point prevalence frequency of 50% or greater. The default in the system assumes that signs not entered on the list were checked but were not present. The signs providing the best prototype descriptions from the B.S.E database in chapter six were entered and analyzed according to the four models described in chapter six.

7.3 Results

The signs entered and the results of the four models for the 55 diseases in the database are shown in appendix 5. Table 7.01 summarises the rankings of the prototypes using the 4 models.

Model 4 identified 27 prototype disease profiles correctly

Table 7.01 Table of the rank position of the database conditions using models 1,2,3 and 4

	Rank of diagnosis			
Case number	Model 1	Model 2	Model 3	Model 4
1	7	7	11	9
2	7	7	8	7
3	1	1	1	1
4	1	1	1	1
5	5	5	5	5
6	1	1	1	1
7	1	1	1	1
8	2	2	1	1
9	1	1	1	1
10	11	11	6	5
11	9	6	3	3
12	6	6	2	2
13	11	11	1	1
14	5	5	1	1
15	1	1	1	1
16	2	2	3	2
17	2	2	11	11
18	2	2	9	5
19	1	1	4	1
20	2	2	1	1
21	10	10	2	2
22	3	3	2	2
23	5	2	3	2
24	1	1	1	1
25	1	1	1	1
26	3	3	5	2
27	11	11	3	2
28	1	1	4	4

	Rank of diagnosis			
Case number	Model 1	Model 2	Model 3	Model 4
29	9	9	7	6
30	3	3	5	2
31	3	2	2	2
32	1	1	1	1
33	2	2	4	3
34	3	3	3	3
35	11	11	1	1
36	8	5	1	1
37	1	1	1	1
38	3	3	1	1
39	7	7	1	1
40	3	3	2	2
41	2	2	1	1
42	8	8	2	2
43	2	2	1	1
44	11	11	11	11
45	8	6	2	2
46	11	11	1	1
47	2	2	1	1
48	1	1	1	1
49	11	11	3	3
50	6	6	3	1
51	11	11	11	10
52	2	2	1	1
53	2	2	1	1
54	11	11	5	4
55	11	11	3	3
Diagnosis ranked 1	13 (26.3%)	13 (26.3%)	25 (45.5%)	27 (49.1%)
Diagnosis in top 5	34 (61.8%)	36 (65.5%)	47 (85.5%)	49 (89.1%)

by ranking them number one (49.1%). Models 1,2,and 3 identified 13 (23.6%), 13 (23.6%) and 25 (45.5%) respectively. Models 3 and 4 were significantly better than models 1 and 2 using a Chi-squared test with Yates' correction factor ($p<0.05$). There was no significant difference between models 3 and 4 ($p<0.05$).

The number of prototype diseases ranked in the top 5 for models 1,2,3,4 were 34 (61.8%), 36 (65.5%), 47 (85.5%) and 49 (89.1%) respectively. Models 3 and 4 were significantly better than models 1 and 2 using a Chi-squared test with Yates' correction factor ($p<0.05$). There was no significant difference between models 3 and 4 ($p<0.05$).

7.4 Discussion

This experiment used data with a high degree of reliability. The sequence of model performance going from the best to the worst was 4,3,2,1. The models which used signs observed to be present and signs observed to be absent were significantly better than models which used signs observed only. The best model in the experiment model 4 which used signs present, signs absent and logical exclusion.

The relatively low performance of model 4 in identifying only 49 % of the prototype disease and ranking 89.1% in the top 5 rankings can be explained by the restriction of the disease profile descriptions to 14 clinical signs observed in B.S.E..

Uncertainty regarding the data reliability is also a consideration. Model 3 has the best pattern matching algorithm when allowing for the maximum degree of uncertainty. In this model there is summation of the point prevalence frequencies of the signs observed to be present and absent but no logical exclusion is applied.

To allow for uncertainty in the system models 3 and 4 could be combined into a single model which allows the clinician to nominate whether logical exclusion should operate or not depending upon the clinicians' confidence in the reliability of the observations of the patient. Bovid (Blood *et al*, 1989), a probability model has such as system.

Formal methods of dealing with uncertainty have been described in the introduction and include fuzzy logic (Zadeh, 1965; Adlassnig, 1986), the Dempster-Schafer Theory (Lucas and van der Gaag, 1991) and probabilities (Warner *et al*, 1961).

Using prototype descriptions of disease these models can produce a ranked list of conditions which most closely match a nominated disease. This order is constant unless the prototype descriptions are changed. This provides a rational taxonomy which could be used in teaching to highlight which conditions are closely related regarding their point prevalence frequency profiles.

Chapter 8
B.S.E. Case Reports

8.1 Introduction

Chapter 6 compared the performance of the B.S.E pattern matching models using prototype profiles of the diseases within the database. This experiment examines the performance of the B.S.E pattern matching models with 50 confirmed B.S.E. cases and compares their performance to final year veterinary students.

Test sensitivity is defined as the likelihood of a positive test result in patients known to have the disease. Test specificity is the likelihood of a negative result in patients known to be free of the disease. Sensitivity and specificity are both required to compute the accuracy of a test. The accuracy of a test is the proportion of all tests, both negative and positive that are correct (Smith, 1991).

The pattern matching models and the veterinary students can be considered "tests" of whether a patient has B.S.E. or not. Sensitivities can be measured by presenting confirmed B.S.E. cases. Measuring the specificity of a test is much more problematical.

In order to measure the specificities samples would have to taken from a population in which the relative prevalences of competing diseases and the relative prevalences of the different stage presentations of those diseases were representative of the test population. This data does not exist with regards to the B.S.E differential diagnoses.

In this experiment the pattern matching models and the veterinary students were provided with confirmed B.S.E. case reports and their sensitivities were computed.

8.2 Materials and methods

Fifty confirmed B.S.E case reports were provided by MAFF (MAFF, 1996). These cases had been confirmed by histopathology on brain sections. The case reports contained information regarding the absence or presence of the 14 signs on the system check list described in chapter 6.

The 14 sign B.S.E case profiles were presented to Cambridge University final year veterinary students in their final term. Each student was provided with two case descriptions. The students were informed that the cases in question were dairy cows over 2 years of age and that the cases were B.S.E suspects. The students were asked to decide if the case should be slaughtered and submitted as an unconfirmed B.S.E case.

The same data was entered into the B.S.E pattern matching system. The data entered is shown in appendix 6.

8.3 Results

The results of the pattern matching models are shown in appendix 6. These results are summarised in table 8.01. The results for final year veterinary students are shown in table 8.01. The models 1,2,3,4 had sensitivities of 96% (48/50), 98% (49/50), 50% (25/50) and 88% (44/50) respectively. The veterinary students had a sensitivity of 62 % (31/50). A Chi-square test with Yates' correction factor was used to compare the results. Models 1,2, and 4 were significantly better than veterinary students and model 3 regarding their sensitivities ($p<0.05$). There was no significant difference between model 3 and the veterinary students ($p<0.05$). Models 1,2, and 4 were not significantly different from each other ($p<0.05$).

Table 8.01 Table of the rank position of the B.S.E. case reports

	Rank of B.S.E.				
Case	Model 1	Model 2	Model 3	Model 4	Veterinary Students
1	1	1	1	1	B.S.E
2	1	1	1	1	B.S.E
3	1	1	1	1	B.S.E
4	1	1	49	1	-
5	1	1	8	1	B.S.E
6	1	1	2	1	B.S.E
7	1	1	1	1	B.S.E
8	1	1	8	1	B.S.E
9	1	1	49	1	B.S.E
10	1	1	2	1	B.S.E
11	1	1	1	1	B.S.E
12	1	1	1	1	B.S.E
13	1	1	1	1	B.S.E
14	1	1	1	1	-
15	1	1	4	4	-
16	1	1	4	1	-
17	1	1	10	1	-
18	1	1	1	1	B.S.E
19	1	1	1	1	-
20	1	1	1	1	B.S.E
21	1	1	40	2	-
22	1	1	1	1	B.S.E
23	1	1	1	1	B.S.E
24	1	1	35	1	-
25	1	1	4	1	B.S.E
26	1	1	1	1	B.S.E
27	1	1	1	1	B.S.E

	Rank of B.S.E.				
Case	Model 1	Model 2	Model 3	Model 4	Veterinary Students
28	1	1	42	3	-
29	1	1	1	1	B.S.E
30	1	1	41	1	-
31	1	1	1	1	B.S.E
32	1	1	1	1	B.S.E
33	2	2	54	6	-
34	1	1	3	1	B.S.E
35	1	1	1	1	B.S.E
36	1	1	33	1	-
37	1	1	21	1	-
38	1	1	13	1	B.S.E
39	1	1	1	1	-
40	1	1	1	1	B.S.E
41	1	1	1	1	B.S.E
42	1	1	48	6	-
43	1	1	1	1	-
44	1	1	1	1	B.S.E
45	4	1	55	2	-
46	1	1	2	1	B.S.E
47	1	1	2	1	B.S.E
48	1	1	1	1	-
49	1	1	3	1	B.S.E
50	1	1	30	1	-
Diagnosis ranked 1	48(96%)	49(98%)	25 (50%)	44(88%)	31(62%)

8.4 Discussion

This study examined the sensitivities of 4 pattern matching models and a group of final year veterinary students when presented with reliable information from confirmed B.S.E cases. The sensitivity and the false negative rate describe how the test performs in patients with the disease but makes no measure of the false positive rate or how the test performs in patients without the disease. An ideal diagnostic model would have 100% sensitivity and 100% specificity. Models 1,2, and 4 had statistically significantly higher sensitivities than the veterinary students. Model 2 had the highest sensitivity. A more sensative test improves the negative predictive value of the test with fewer false negative result. However, model 4 was the most accurate model at pattern matching using the disease database prototype analysis in chapter 7. This suggests that model 4 probably has a higher sensitivity than model 2. Model 2 used the summation of the point prevalence frequencies of the signs observed to be present with exclusion. Model 4 used summation of the point prevalence frequencies of the signs observed to be present and absent with exclusion.

Pattern matching models 1,2, and 4 were therefore superior to the veterinary students in identifying B.S.E cases in animals which have B.S.E. in this experiment. The performance of the models is related to the reliability of the information supplied. Model 3 had the lowest sensitivety. This model assums the greatest amount of uncertainty with regards to the input data. No logical exclusion is applied. The more unreliable the information supplied to the system the greater is the chance of the diagnosis being excluded if a model applys logical exclusion. In the case of model 3 the diagnosis would never be excluded and would be preserved as a differential with inaccurate observations. The cost is reduced sensitivety with reliable data.

Chapter 9
Information Retrieval and Diagnosis

9.1 Introduction

This experiment was designed to examine the efficiency of information retrieval and diagnostic accuracy of six veterinarians and a hypothetico-deductive pattern matching model of diagnosis.

The experimental design was partly based on Kleinmuntz's (1984) study of neurologists, de Groote's (1965) study of chess and Miller *et al* (1982).

9.2 Materials and Methods

The six veterinarians used in the experiment were members of the Department of Production Animal Medicine and Surgery of the Faculty of Veterinary Science, Medical University of Southern Africa (Medunsa). The hypothetico-deductive pattern matching model (model 5) was described in chapter two.

An incomplete list of attributes from six cattle disease case reports were presented to the veterinarians and the hypothetico-deductive pattern matching model. These are listed in table 9.01. The case reports were compiled from the clinical information listed in bovid. This method was used to achieve a detailed description but goes against the warnings of Rogers *et al* (1979) regarding the introduction of bias by using the data base for test data.

The veterinarians and the hypothetico-deductive pattern matching model had 20 questions with which to identify the case abnormalities and attempt a diagnosis. Attributes within the case reports with a point prevalence frequency of 50 percent and greater were assumed to be present and

Table 9.01 Case reports compiled from Bovid

1. Bladder rupture

Case history

Twelve month old
Male
Castrated
Hereford
Abdominal swelling

Additional signs present

Temperature > 39.5 C
Heart rate > 100 per minute
Rumen movements absent (0 per 2 minutes)
Feed intake < 50 % of normal
No urine passed
Hyposensative to external stimuli
Abdominal paracentesis yields urine
Blood urea nitrogen elevated
Blood creatinine elevated

2. Amyloidosis

Case history

Adult
Ayrshire
Female
Loss of weight
Chronic diarrhoea

Additional signs present

Course of disease more than 2 weeks
weight gain reduced or weight loss
Feed intake < 50 % of normal
Polydipsia
Milk yield below normal
Ventral body wall swelling
Liver enlarged or painful
Spleen enlarged or painful
Kidneys enlarged or painful
Urine contains protein
Blood urea nitrogen elevated
Blood calcium low
Blood magnesium low

3. Mucosal disease

Case history

Eighteen months old
Female
Ayrshire
Acute diarrhoea

Additional signs present

Temperature > 39.5
Heart rate > 100 per minute
Rumen movements absent (0 per two minutes)
Dehydration
Weight gain reduced or weight loss
Feed intake < 50 % of normal
Milk yield below normal
Oral mucosal lesions
Oral mucosal erosions
Nasal mucosal erosions
Nasal mucosal erosions, ulcers, necrosis
Nasal discharge
Nasal discharge mucopurulent
Dermatitis of muzzle
Saliva frothy
Coronet erosions or scabs
Blood leucopenia

4. Vegetative endocarditis

Case history

Adult
Female
Lactating cow
Brisket oedema
Weight loss

Additional signs present

Course of disease more than two weeks
Temperature > 39.5 C
Respiration increased and shallow
Weight gain reduced or weight loss
Milk yield below normal
Submandibular oedema
Jugular pulse increased
Jugular veins distended
Lung sounds loud
Heart mur mur
Blood haemoglobin low

5. Parturient paresis

Case history

Adult
Friesland
Recumbent
Immediately post partum

Additional signs present

Temperature < 38.0
Rumen movements absent (0 per two minutes)
Feed intake less < 50 %
Recumbent
Hyposensative to external stimuli
Pupil dilatation
Pupillary light response absent
Muzzle dry
Jugular vein collapsed
Heart sounds soft and muffled
Anal reflex absent
Faeces dry and firm
Generalised flaccid paralysis
Blood calcium low

6. Copper deficiency

Case history

Male
Hereford
Ten months old
weight gain reduced
Gait stiff

Additional signs

Course of disease more than two months
Mucosae pale
Weight gain reduced or weight loss
Feed intake < 50 % of normal
Gait stiff
Conjunctival pallor
Hair hypopigmented
Erythrocyte count low
Blood haemoglobin low

attributes below 50 percent absent. The veterinarian was instructed to terminate the questions when convinced of the diagnosis and to try and achieve a diagnosis in the minimum number of questions. The Hypothetico-deductive pattern matching model was terminated when the leading hypothesis was identical on two consecutive questions. A leading hypothesis was requested every 5 questions from the veterinarians.

To avoid interviewer bias clinical attribute cards were prepared (Elstein *et al*, 1978). The subject was to remove a sticker to get the answer to a question. This created a list of 400 clinical attributes. In a trial of this method location of the attribute in question proved very slow and this method was abandoned in favour of an interview.

The veterinarian had a printed copy of the case history and a record sheet to record the questions that were asked and the answers that were given.

Process tracing using Bovid was performed on the results of the interview with the veterinarians and the hypothetico-deductive pattern matching model. Bovid generates probabilities assuming conditional independence using Bayes' theorem.

9.3 Results

9.3.1. Correct diagnosis and the number of questions

Two parameters that can be used to measure diagnostic efficiency are the number of correct diagnoses achieved within the twenty questions and the number of questions taken to achieve the correct diagnosis. The number of correct diagnoses against the number of questions asked when the correct diagnosis was made are presented in figure 9.01 and table 9.02. The four quadrants represent the combinations of good and poor performance for the two parameters. The pattern matching model had the best performance by asking the least number of questions and achieving the greatest number of correct diagnoses.

The veterinarians correctly identified 27 diagnoses out of 36 case presentations within the twenty questions.The hypothetico-deductive pattern matching model identified all the cases correctly (6/6). A Chi-squared test using Yates' correction factor was not significant when the number of correct diagnoses were compared ($p < 0.05$). The mean number of correct diagnoses for the veterinarians was 4.50 (range 2-6).

In the cases that were diagnosed correctly the mean number of questions asked by the veterinarians was 9.57 (range 2-20) questions and by the pattern matching model was 6.17 (range 3-10) questions. A two times two contingency table test using Yates' correction factor was used to compare the proportions of the number of questions asked and the unused questions for the veterinarians and the pattern matching model when a correct diagnosis was made (Statistix, 1992). The proportion of the number of available questions asked in the cases that were diagnosed correctly was 48 percent (249/520) for the veterinarians and 31 percent (37/120) for the pattern matching model. There were significantly fewer questions asked by the pattern matching model($p < 0.05$).

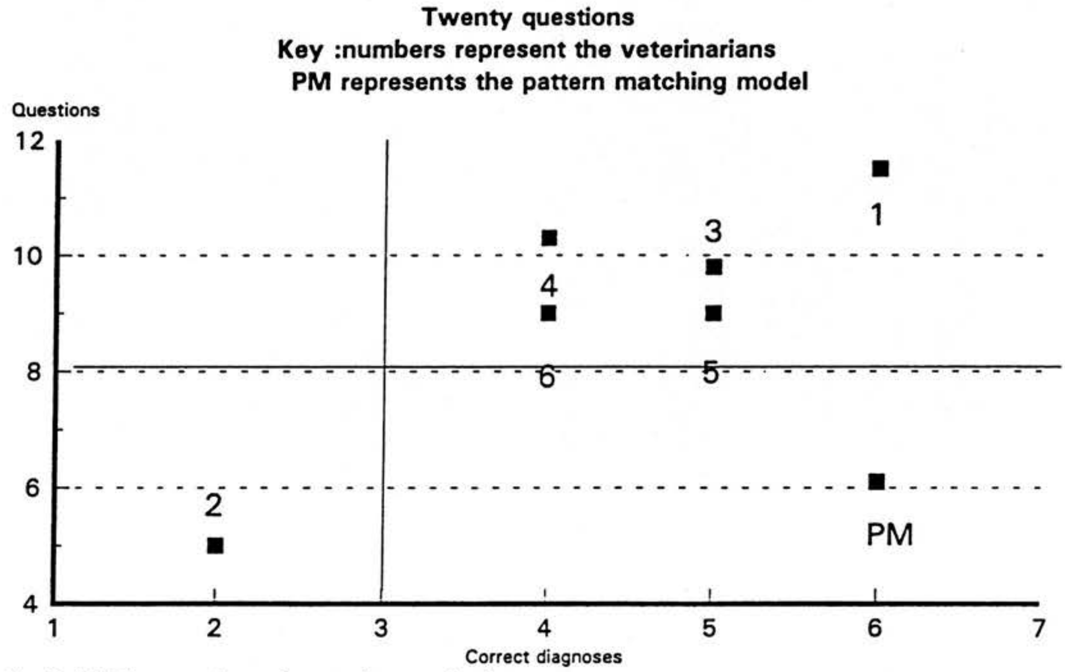

Fig 9.01 The number of questions asked at termination when a correct diagnosis was made against the number of correct diagnoses

Table 9.02 The number of questions asked when the diagnosis was correct

	Number of questions asked by the veterinarians						
Case	V1	V2	V3	V4	V5	V6	PM Model
2	20	2	6	4	5	3	7
5	9	-	-	-	14	-	7
10	9	-	11	15	7	15	3
11	13	-	13	16	10	10	7
17	8	8	3	6	9	8	3
18	10	-	16	-	-	-	10
Correct diagnoses	6	2	5	4	5	4	6
Total Questions	69	10	48	41	45	36	37

9.3.2 Process tracing using Bovid

The probability and rank of the case diagnosis by question number for each veterinarian are shown in tables 9.03 to 9.08.

The hypothetico-deductive pattern matching model had the diagnosis in the top rank in six out of six cases using the probability analysis in bovid.

The veterinarians had 23 out of 36 diagnoses in the top rank position at the termination according to the probability analysis. In four answers the correct diagnosis was obtained without the diagnosis being in the top rank according to the probability analysis. In two answers by the veterinarians the diagnosis was in the top rank position at termination according to the probability analysis but the veterinarians made a different and incorrect diagnosis.

The mean probabilities at termination for the cases with the correct diagnosis by the veterinarians and the pattern matching model were 73 % (range 3-100) and 78 % (58-100) respectively.

9.3.4 Inclusive and exclusive questions

The question following a statement identifying the leading hypothesis was classified as inclusive or exclusive. An exclusive question was unrelated to the abnormalities included in the leading hypothesis. An inclusive question was a question concerning the abnormalities listed in the leading hypothesis. The results are shown in table 9.09. A two times two contingency table test using Yates correction factor was used to compare their proportions (Statistix, 1992). There were 53 percent (20/38) inclusive and 47 percent (18/38) exclusive questions. There was no significant difference ($p<0.05$).

Table 9.03 Rank and probability by question of the case 2 diagnosis

Q	Veterinarians						
	Vet1 R P	Vet2 R P	Vet3 R P	Vet4 R P	Vet5 R P	Vet6 R P	PM R P
0	19 (1)	19 (1)	19 (1)	19 (1)	19 (1)	19 (1)	19 (1)
1	6 (5)	5 (6)	8 (3)	19 (1)	10 (10)	1 (79)	18 (1)
2	6 (5)	1 (95)	8 (3)	1 (81)	7 (7)	1 (81)	15 (2)
3	6 (5)		7 (4)	1 (83)	1 (95)	1 (98)	15 (2)
4	6 (5)		5 (6)	1 (98)	1 (100)		16 (2)
5	13 (2)		1 (97)		1 (100)		1 (88)
6	13 (2)		1(100)				1 (99)
7	13 (2)						1(100)
8	13 (2)						
9	9 (4)						
10	7 (4)						
11	6 (4)						
12	6 (5)						
13	4 (6)						
14	4 (7)						
15	4 (7)						
16	4 (8)						
17	3 (15)						
18	1 (62)						
19	1 (62)						
20	1 (62)						
	YES	YES	YES	YES	YES	YES	YES

Key
PM pattern matching
P probability
R rank
YES/NO correct/incorrect
Q question number

Table 9.04 Rank and probability by question of the case 5 diagnosis

Q	Veterinarians						
	Vet1 R P	Vet2 R P	Vet3 R P	Vet4 R P	Vet5 R P	Vet 6 R P	PM R P
0	12 (2)	12 (2)	12 (2)	12 (2)	12 (2)	12 (2)	12 (2)
1	11 (2)	8 (2)	5 (2)	8 (2)	11 (3)	11 (2)	2 (14)
2	6 (3)	8 (2)	6 (2)	10 (3)	6 (4)	12 (2)	2 (14)
3	6 (3)	6 (3)	4 (4)	10 (3)	6 (4)	10 (3)	2 (14)
4	6 (3)	6 (3)	2 (5)	10 (3)	6 (4)	15 (0.5)	3 (12)
5	5 (3)	7 (3)	2 (6)	9 (3)	6 (4)	15 (0.5)	3 (11)
6	2 (4)	7 (3)	3 (4)	9 (3)	6 (4)	14 (0.5)	1 (28)
7	1 (65)	16 (0.5)	3 (4)	9 (3)	6 (4)	15 (1)	1 (98)
8	1 (85)	16 (0.5)	3 (4)	14 (1)	6 (4)	15 (1)	
9	1 (85)		3 (4)	14 (1)	4 (4)	15 (1)	
10			3 (5)	14 (1)	4 (5)	15 (1)	
11			3 (5)	14 (1)	4 (5)	15 (1)	
12			3 (5)	14 (2)	1 (5)	14 (1)	
13				9 (0)	1 (28)	8 (2)	
14				12 (0)	1 (72)	8 (2)	
15						8 (2)	
16						6 (2)	
17						2 (35)	
18						2 (35)	
19						2 (35)	
20						2 (35)	
	YES	NO	NO	NO	YES	NO	YES

Key
PM pattern matching
P probability
R rank
YES/NO correct/incorrect
Q question number

Table 9.05 Rank and probability by question of the case 10 diagnosis

Q	Veterinarians													
	Vet1		Vet2		Vet3		Vet4		Vet5		Vet6		PM	
	R	P	R	P	R	P	R	P	R	P	R	P	R	P
0	5	(5)	5	(5)	5	(5)	5	(5)	5	(5)	5	(5)	5	(5)
1	5	(5)	3	(2)	5	(5)	5	(5)	1	(19)	6	(5)	3	(6)
2	6	(1)	4	(2)	5	(6)	3	(6)	1	(21)	6	(1)	1	(61)
3	6	(1)	2	(15)	4	(2)	4	(3)	2	(9)	5	(1)	1	(86)
4	6	(36)	2	(15)	6	(12)	4	(7)	2	(7)	5	(1)		
5	1	(43)	2	(18)	3	(39)	1	(31)	2	(20)	5	(1)		
6	1	(44)	2	(22)	1	(12)	1	(31)	2	(24)	5	(4)		
7	1	(45)	4	(8)	2	(14)	1	(31)	1	(70)	5	(1)		
8	1	(45)	2	(26)	2	(73)	1	(31)			5	(4)		
9	1	(45)	2	(18)	1	(73)	1	(31)			5	(4)		
10					1	(73)	1	(39)			2	(4)		
11					1	(73)	1	(39)			2	(24)		
12							1	(40)			3	(24)		
13							1	(62)			3	(18)		
14							1	(62)			3	(18)		
15							1	(63)			3	(18)		
16														
17														
18														
19														
20														
	YES		NO		YES		YES		YES		YES		YES	

Key
PM pattern matching
P probability
R rank
YES/NO correct/incorrect
Q question number

Table 9.06 Rank and probability by question of the diagnosis of case 11

Q	Veterinarians						
	Vet1 R P	Vet2 R P	Vet3 R P	Vet4 R P	Vet5 R P	Vet6 R P	PM
0	8 (<1)	8 (<1)	8 (<1)	8 (<1)	8 (<1)	8 (<1)	8 (<1)
1	8 (<1)	8 (<1)	9 (<1)	2 (13)	8 (1)	5 (<1)	8 (<1)
2	7 (<1)	8 (1)	9 (<1)	2 (11)	8 (1)	4 (<1)	7 (<1)
3	7 (1)	7 (1)	9 (<1)	2 (15)	8 (1)	4 (<1)	8 (<1)
4	7 (1)	8 (2)	9 (<1)	2 (31)	6 (6)	4 (<1)	7 (<1)
5	7 (1)	8 (2)	9 (<1)	2 (28)	6 (6)	4 (<1)	6 (<1)
6	7 (<1)	5 (4)	9 (<1)	2 (31)	2 (29)	4 (<1)	1 (2)
7	7 (<1)	5 (5)	9 (<1)	2 (32)	2 (42)	4 (<1)	1 (87)
8	6 (5)		8 (<1)	2 (21)	1 (56)	4 (<1)	
9	7 (5)		8 (<1)	2 (21)	1 (96)	4 (1)	
10	1 (72)		1 (<1)	2 (22)	1 (96)	3 (3)	
11	1 (73)		1 (<1)	1 (63)			
12	1 (75)		1 (39)	1 (55)			
13	1 (76)		2 (66)	1 (55)			
14				1 (55)			
15				1 (55)			
16				1 (57)			
17							
18							
19							
20							
	YES	NO	YES	YES	YES	YES	YES

Key
PM pattern matching
P probability
R rank
YES/NO correct/incorrect
Q question number

Table 9.07 Rank and probability by question of the case 17 diagnosis

Q	Vet 1 R P	Vet2 R P	Vet3 R P	Vet4 R P	Vet5 R P	Vet6 R P	PM R P
	Veterinarians						
0	4 (13)	4 (13)	4 (13)	4 (13)	4 (13)	4 (13)	4 (13)
1	1 (97)	3 (15)	1 (54)	1 (96)	4 (14)	1 (87)	1 (65)
2	1(100)	3 (16)	1 (55)	1 (97)	4 (11)	1 (88)	1 (67)
3	1(100)	1 (55)	1 (55)	1(97)	1 (50)	1 (67)	1 (80)
4	1(100)	1 (84)		1(100)	1 (71)	2 (15)	
5	1(100)	1 (84)		1(100)	1 (73)	2 (18)	
6	1(100)	1 (81)		1(100)	1 (73)	1 (64)	
7	1(100)	1 (83)			1 (73)	1 (64)	
8	1(100)	1 (84)			1 (83)	1 (69)	
9					1 (98)		
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
	YES	YES	YES	YES	YES	YES	YES

Key
PM pattern matching
P probability
R rank
YES/NO correct\incorrect
Q question number

Table 9.08 Rank and probability by question for the case 18 diagnosis

Q	Veterinarians						
	Vet1 R P	Vet2 R P	Vet3 R P	Vet4 R P	Vet5 R P	Vet6 R P	PM R P
0	5 (4)	5 (4)	5 (4)	5 (4)	5 (4)	5 (4)	5 (4)
1	4 (5)	4 (5)	22 (4)	5 (4)	6 (2)	5 (4)	5 (5)
2	3 (8)	4 (5)	22 (<1)	5 (4)	5 (2)	5 (4)	5 (5)
3	3 (8)	4 (5)	14 (<1)	5 (5)	5 (2)	5 (4)	7 (4)
4	3 (8)	6 (4)	14 (<1)	5 (5)	5 (2)	5 (4)	2 (15)
5	1 (28)	6 (4)	14 (<1)	4 (6)	5 (2)	7 (4)	2 (17)
6	1 (31)	6 (4)	14 (<1)	4 (6)	4 (7)	7 (4)	2 (17)
7	1 (69)	4 (6)	12 (<1)	4 (6)	4 (7)	5 (5)	2 (17)
8	1 (69)	4 (7)	9 (2)	5 (6)	4 (7)	5 (5)	2 (23)
9	1 (93)	4 (7)	9 (1)	4 (7)	4 (9)	3 (8)	1 (58)
10	1 (94)	4 (7)	9 (1)	4 (7)	4 (15)	3 (8)	
11		3 (10)	9 (1)	4 (7)	4 (15)	3 (9)	
12		3 (10)	8 (1)	4 (7)	4 (16)	3 (9)	
13		3 (10)	8 (1)	3 (10)	3 (16)	2 (10)	
14		3 (10)	3 (1)	3 (10)	3 (16)		
15		3 (10)	3 (24)	4 (8)	4 (13)		
16			3 (23)	1 (30)	4 (13)		
17				1 (30)	1 (51)		
18				1 (30)	1 (52)		
19				1 (30)	1 (64)		
20				1 (30)	1 (64)		
	YES	NO	YES	NO	NO	NO	YES

Key
PM pattern matching
P probability
R rank
YES/NO correct/incorrect
Q question number

Table 9.09 Twenty questions: the question type following the leading hypothesis declaration

Veterinarian	Inclusive	Exclusive
1	5	5
2	-	-
3	4	3
4	5	7
5	6	3
6	-	-
Totals	20	18

9.3.5 Logical exclusion and diagnosis

Logical exclusion is the exclusion of a differential diagnosis on the basis of an attribute being seen that is not present in the disease description or an attribute being absent when it is always present.

The number of differential diagnoses remaining after logical exclusion in the cases that were correctly diagnosed using the attributes identified are shown in table 9.10. The hypothetico-deductive pattern matching model identified a single diagnosis in five out of six cases. The veterinarians identified a single diagnosis in 14 out of 36 cases with a mean of 2.33 (range 2-4) single diagnoses. The number of single diagnoses at termination for the veterinarians and the pattern matching model was compared using a two times two contingency table test with Yates' correction factor (Statistix, 1992). There was a significantly greater number of single diagnoses at termination with the pattern matching model ($p< 0.05$).

Discussion

Hypothetico-deductive reasoning is a highly flexible approach to diagnosis and is commonly used in veterinary medicine. The initial hypotheses are derived from the primary data entry and subsequent data collection is guided by the leading hypothesis and the competing hypotheses under consideration.

The diagnostic performance of a hypothetico-deductive pattern matching model of diagnosis and six veterinarians were compared.

The hypothetico-deductive model was able to produce an efficient clinical examination with the identification of highly discriminatory information and accurate diagnoses. The performance of the system was equivalent to, or better

Table 9.10 The number of differential diagnoses at termination following logical exclusions in cases that were diagnosed correctly

Case	Veterinarians						
	V1	V2	V3	V4	V5	V6	PM
2	1	1	1	1	1	1	1
5	1	-	-	-	4	-	1
10	4	-	10	4	14	5	3
11	5	-	5	13	2	3	1
17	1	1	1	1	1	1	1
18	1	-	5	-	-	-	1
Number of logical diagnoses	4	2	2	2	2	2	5

than the veterinarians.

The most experienced veterinarian attained the highest number of correct diagnoses and asked the least number of questions. This trend could not be confirmed in the other veterinarians with regard to their rank by experience.

In a study of neurologists Kleinmuntz (1968) reported that the more experienced diagnosticians asked fewer questions and focused on those which were likely to maximise the information yielded. Kaisser *et al* (1978), observed that less questions were asked to retrieve the same information by experienced clinicians. Sackett *et al* (1991) found that in human clinicians the diagnostic strategy of pattern recognition and hypothetico-deductive reasoning improved with experience.

Barrows *et al* (1978) found that experienced clinicians actively search for data to confirm hypotheses rather than rule them out. Shortliffe (1984) states that the process of hypothetico-deductive reasoning includes ruling out less likely competitors. In this study the search for cues after the declaration of a leading hypothesis was evenly split between a search for confirmatory cues and other cues.

Logical exclusion analysis of the differential diagnoses indicated that a single correct diagnosis had been achieved in some cases by the point of termination. The greatest number of single diagnoses at termination following exclusion analysis was achieved by the pattern matching model. This would suggest the discriminatory quality of the diagnostic information retrieved by the model was better than the veterinarians.

The most experienced veterinarian had the greatest number of single diagnoses when logical exclusion was applied. Exclusion may be an important heuristic in partial profile pattern recognition in veterinary hypothetico-deductive reasoning if the attribute has a high reliability. The dangers of exclusion based on inaccurate cue identification should not be under estimated (White, 1988b; White, 1984).

Chapter 10
Heuristic ability

10.1 Introduction

The ability to perform a diagnosis has two components:

1. the reference database of disease descriptions held in the memory and

2. the heuristics or methodologies needed to perform hypothetico-deductive reasoning.

The reference database in memory can be isolated from the heuristics by the use of numerical models instead of diseases. The heuristic abilities of the veterinarians.

The heuristics under investigation were:

1. recognition of the leading hypothesis,

2. logical exclusion and

3. the identification of the attribute with the greatest differentiating value.

10.2 Materials and Methods

A theoretical table of diseases and their attributes was provided. This is reproduced in table 10.01. The table contains six diseases of equal marked A to F with 8 attributes marked 1 to 8. The attribute point frequency for each clinical finding within a disease is given. No relational or functional information was provided. This table was used in all the experiments. The correct answers were determined by probability theory using Bayes theorem.

The results of 16 clinical examinations are shown in table 10.02. The veterinarians had to identify the leading hypotheses and the diseases which could logically be discounted on the information provided.

The results of a partial clinical examination were given and the leading and competing differential diagnoses identified. These are presented in table 10.03. The veterinarians were asked to identify the attribute which would maximally differentiate or distance the leading hypothesis from the competing differential diagnoses by the greatest margin.

10.3 Results

The results of the investigation into logical exclusion ability and the identification of the leading hypothesis are shown in table 10.04. The leading hypothesis, correct exclusions and incorrect exclusions were achieved in 86.2%, 96.6% and 11.1% instances respectively.

The number of correct answers given by each veterinarian are shown in figure 10.01. The optimal sign to examine next was achieved in 58 percent (35/60) of the cases.

10.4 Discussion

This was a pilot study to investigate some aspects of heuristic ability independently of disease knowledge. The ability to apply logical exclusion was high but not perfect and formal instruction in set theory may improve this ability. Pattern recognition ability in identifying the leading hypothesis was high. Identification of the attribute with the highest differentiating power was the weakest heuristic and formal instruction in theoretical algorithms should improve this ability. Further research is required to study heuristic ability to identify where formal instruction may be of assistance in improving them.

Table 10.01 Point prevalence frequencies of attributes 1 to 8 for diseases A to F

Attributes	Diseases A	B	C	D	E	F
1	10	20	0	40	60	5
2	70	40	80	60	90	30
3	80	90	40	50	5	80
4	0	60	60	5	0	40
5	100	0	40	90	50	70
6	20	0	0	20	0	100
7	0	65	0	0	70	90
8	50	0	40	80	0	0

Table 10.02 Identification of the leading hypothesis and the diseases which can be logically excluded

Positive= The attribute is present
Negative= The attribute is absent

Questions

Question	Attributes examined	Positive	Negative
1a	1,2,3,4	1,2,3	4
1b	1..8	1,2,3	4,5,6,7,8
2a	2,3,4,5	2,3,4	5
2b	1..8	2,3,4	1,5,6,7,8
3a	4,5,6,8	6,8	4,5
3b	1..8	2,6,8	1,3,4,5,7
4a	1,2,6,7,8	1,2,8	6,7
4b	1..8	1,2,3,4,8	5,6,7
5a	2,4,6,8	6,8	2,4
5b	1..8	1,3,6,8	2,4,5,7
6a	1,3,5,7	3,5	1,7
6b	1..8	3,5,8	1,2,4,6,7
7a	2,4,5,7	2,4	5,7
7b	1..8	2,4,6,8	1,3,5,7
8a	1,2,4,8	2,4,8	1
8b	1..8	2,3,4,5,6,8	1,7

Answers

	Leading hypothesis	Exclusions
1a	A	C
1b	E	A,C,F
2a	B	A,E
2b	B	A,E,F
3a	D	B,C,E,F
3b	D	
4a	D	C,B,E,F
4b	D	A,B,C,E,F
5a	D	B,E,F,C
5b	D	A,B,E,F,C
6a	A	B
6b	A	B,E,F
7a	C	A,E
7b	D	A,B,C,E,F
8a	C	A,B,E,F
8b	D	A,B,C,E,F,

Table 10.03 Identification of the optimal attribute to examine next

	Attributes examined	Attributes present	absent	Leading hypothesis	Competing diseases
1.	1,2,3,4	1,2	3,4	E	A,B,D,F
2.	5,6,8	8	5,6	C	D
3.	3,4,5,6	3,4	5,6	B	D,C
4.	3,5,6,7	3,5	6,7	A	C,D,E
5.	1,2,4,6, 8	6,8	1,2,4	D	A
6.	1,3,5,7	1,3,5	7	A	D,E,F
7.	2,4,6,8	2,4,6,8	-	D	D
8.	1,2,5,6, 7,8	1,2,5	6,7,8	E	A,D
9.	4,5,6,7, 8	4,5	6,7,8	C	C,D
10.	1,3,5,6 7	1,3,5	6,7	A	D,E

Answers

1. 7
2. 4
3. 7
4. 1 or 8
5. 3
6. 8
7. D
8. 3
9. 1
10. 8

Table 10.04 Profile recognition and exclusion

Veterinarians	Leading hypothesis	Correct exclusions	Incorrect exclusions
Maximum score possible	16	50	45
V1	16	50	3
V2	10	46	16
V3	13	49	2
V4	12	50	3
V5	16	48	3
V6	16	47	4
Mean	13.8 (86.2%)	48.3 (96.6%)	5.1 (11.1%)

Chapter 11
Discussion

This study has examined pattern recognition methods and in particular pattern matching methods used in veterinary medicine within the domain of cattle diseases.

In the survey of veterinarians and veterinary students pattern matching, pathophysiological reasoning and probabilities were recognised by both groups as pattern recognition strategies used in diagnosis. Veterinary students stated that they used pathophysiological reasoning most often and the veterinarians pattern matching most frequently. Logical exclusion was used provided the data was reliable. The veterinarians stated that they used the signs observed to be absent and the signs observed to be present during pattern recognition.

The three pattern recognition methods: pattern matching, probabilities and pathophysiological or functional reasoning are well recognised in human clinicians (Wulff, 1976; Schmidt *et al*, 1990). The influence of experience on the pattern recognition methods used and the knowledge structures within memory are also well documented for human clinicians (Schmidt *et al*, 1990). The application of logic embodied in set theory, venn diagrams and boolean algebra to pattern recognition in human medicine has been described (Ledley and Lusted, 1959; Fernstein, 1967). The findings in this study are consistent with previous studies in human medicine which demonstrate a switch from deterministic to experiential pattern recognition methods with experience.

The pattern recognition analysis using case reports identified that the pattern recognition method used by the veterinarians was a function of a pattern matching model and not a Bayes' theorem probability model. The be present and absent with logical exclusion.

The B.S.E. pattern matching system and final year veterinary students were tested with confirmed B.S.E case reports. The model with the highest sensitivity used the signs observed to be present with logical exclusion. Three of the models were significantly better than the veterinary students in identifying B.S.E cases in animals which have B.S.E..

Pattern matching using weighted summations have been used in human and veterinary medicine (Miller *et al*, 1982; Pollock, 1984). Most of the systems use subjective, *ad hoc* weightings (Rector, 1984). This system was an attempt to develop a rational method using point prevalence frequencies of signs within diseases as a weighting.

Uncertainty in medical decision making is well recognised and automated expert systems have used a variety of techniques to accommodate the problem (Cohen and Grubber, 1984). This system used the strategy of logical exclusion to allow for certainty in the reliability of the data. If the data was considered unreliable then logical exclusion was not applied. A similar uncertainty system has been used in the veterinary probability decision support system Bovid (Blood *et al*, 1989).

An algorithm was devised to identify the attribute with the highest discriminatory power. This hypothetico-deductive pattern matching model of diagnosis was compared to group of veterinarians. The performance of the model was equivalent to or better than the veterinarians. Studies on heuristics indicated that the weakest heuristic was the identification of the attribute with the greatest discriminatory power.

Hypothetico-deductive systems in human and veterinary medicine have used probability and weighted summation algorithms to suggest attributes to examine next (Miller *et al*, 1982; Blood *et al*, 1989).

The documented clinical signs of diseases may be inadequate to allow optimum disease diagnosis (Fessler, 1984; Croft, 1972). The reporting of disease descriptions by sign sensitivity in the literature is routine. This collation of information results in the loss of conditional dependency of the clinical signs. Disease profiles should be reported as they appear in their relational sets of signs. This information will be required if the accuracy of probability and pattern matching models are to be improved.

APPENDIX 1

Bayes' theorem (Blood and Brighling, 1988)

$$P(\text{Disease A}|\text{Findings}(1,2,3)) = \frac{P(\text{Findings }(1,2,3)|\text{Disease A}) \times P(\text{Disease A})}{P(\text{Findings}(1,2,3))}$$

P(Disease A|Findings(1,2,3)) is the probability that Disease A is present given the observations of a specific set of signs (Findings(1,2,3)).

P(Findings(1,2,3)|Disease A) is the probability that the set of clinical signs (1,2,3) occurs in the disease (Disease A).

P(Disease A) is the prevalence of the disease at the time of clinical examination.

P(Findings(1,2,3)) is the probability that the patients set of clinical signs could observed at the time of examination.

Or

P(D!S) = P(S!D) x P(D)/P(S)

P(D!S) the probability of the disease being present given the particular sign (S) has been observed.

P(S!D) the probability of observing the sign (S) given that the disease is present.

P(D) the fequency of the disease in the population (disease prevalence)

P(S) the frequency of the sign (S) in the population at large.

APPENDIX 2

Pivotal exclusion signs used in the generation of probabilities by Bovid for the case report differential diagnoses

1. Salt poisoning

Nystagmus
Recumbency
Convulsions

2. Bladder rupture

Abdomino-centesis yields urine

3. Post-parturient haemoglobinuria

Urine red
Erythrocyte count low

4. Renal amyloidosis

Kidneys enlarged and painful

5. Monensin poisoning

Jugular vein distended

6. Bovine spongiform encephalopathy

Aggressive actions

7. Malignant catarrhal fever

Oral mucosal erosions

8. Rabies

Paresis

9. Ephemeral fever

Temperature > 39.5 C
Gait stiff

10. Mucosal disease

Oral mucosal erosions, ulcers and necrosis

11. Bovine valvular endocarditis

Heart rate > 100 per minute
Brisket oedema

12. Sporadic bovine leucosis

Lymph-nodes enlarged

13. Bovine ketosis

Urine ketones
Blood sugar low

14. Sub-acute lead poisoning

Jaw champing

15. Traumatic reticulo-pericarditis

Pericardio-centesis yields inflammatory fluid

16. Pyrexia pruritus and haemorrhage

Self licking, rubbing, chewing

17. Post parturient paresis

Blood calcium low

18. Copper deficiency

Gait stiff
Blood haemoglobin low

APPENDIX 3

The confidence ratings produced by the veterinarians and the profile scores for the case report differential diagnoses.

The differential diagnoses are arranged in ascending profile score. The percentage (%) represents the profile score and gives a measure of the agreement between the observations and the disease profile.

1. Salt poisoning

			Veterinarian confidence rating					
Disease	Profile total	%	V1	V2	V3	V4	V5	V6
1. Salmonella septicaemia	580	73	40				60	
2. Lead poisoning	370	46	60	80	40			60
3. Bacterial meningitis	345	43	60		80	80	80	
4. Echerichia coli septicaemia	335	42	60			60	20	
5. Encephalitis	325	41	60			60		
6. Anaphylaxis	325	41	20					
7. Coccidiosis	325	41	40		40			
8. Listeriosis	315	39	60	60	40	80		80
9. Brain trauma	250	31	40					
10. Heartwater	245	30	60	100		60		80
11. Chlorohydro-carbon poisoning	245	30	40					
12. Hypo-magnesaemia	240	30	40					
13. Vitamin E/selenium deficiency	235	29	20					
14. Cerebro-cortico-necrosis	225	28	40		40	20		

			Veterinarian confidence rating					
Disease	Profile total	%	V1	V2	V3	V4	V5	V6
15. Coenurus cerebralis	225	28	40					
16. Brain abscess	215	27	40					
17. Clostridia tetani	210	26	20					
18. Vitamin A deficiency	195	26	40					
19. Brain neoplasia	185	23	20					
20. Hydro-cephalus	175	22	40					
21. Entero-toxaemia	155	19	40					
22. Infectious bovine rhino-tracheitis	150	19	60					
23. Monensin poisoning	145	18				20		
Salt poisoning	295	37						

2. Rupture bladder

			Veterinarian confidence rating					
Disease	Profile total	%	V1	V2	V3	V4	V5	V6
1. Ruptured bladder	850	65	80	80	100	60	80	80
2. Ruptured ureter	800	62		60			40	60
3. Persistent urachus	800	62				40		60
4. Ruptured kidney cyst	800	62				40		40
5. Pyelo-nephritis	600	46						20
6. Vaginal wall rupture	500	38						80

3. **Post parturient haemoglobinuria**

			Veterinarian confidence rating					
Disease	Profile total	%	V1	V2	V3	V4	V5	V6
1. Post Parturient Haemo-globinuria	805	81	60	100		80		80
2. Water intoxication	690	69	20		20			
3. Bacillary haemo-globinuria	665	67	40		40			
4. Babesiosis	640	64		80	80	80		
5. Copper toxicity	585	59	40			40		
6. Anaplasmosis	520	40						60
7. Eperythro-zooonosis	505	51	20					
8. Warfarin	430	43	20				40	
9. Lepto-spirosis	235	24			60		80	
10. Snake bite	210	21			40			
11. Nephrosis	165	16.5	20					

4. Bovine renal amyloidosis

			Veterinarian confidence rating					
Disease	Profile total	%	V1	V2	V3	V4	V5	V6
1. Nephrosis	515	43	60	60		60	60	60
2. Traumatic reticulo-pericarditis	500	42	40			60		
3. Jones disease	451	38			60			
4. Amyloidosis	440	37	80		60		60	
5. Chronic facioliasis	420	35			40			60
6. Glomerulo-nephritis	415	35		20			80	80
7. Brisket disease	415	35	40			60		
8. Vegetative endocarditis	395	33	40					
9. Bovine viral leucosis	375	31		40				
10. Monensin poisoning	350	30			20			
11. Hydro-nephrosis	340	28	40					
12. Paramphisto-moniasis	330	28			40			
13. Cerebro-cortico-necrosis	320	27			40			
14. Cardio-myopathy	320	26	40					
15. Nagana	285	24	20					
16. Anthrax	260	22		60				

5. Monensin poisoning

			Veterinarian confidence rating					
Disease	Profile total	%	V1	V2	V3	V4	V5	V6
1. Traumatic reticulo-pericarditis	810	74	80	100	80	80	80	80
2. Cor pulmonale	570	52	20					
3. Brisket disease	560	51	40					
4. Vegetative endocarditis	540	49	60			60		
5. Monensin poisoning	475	43	20					
6. Caudal vena cavae syndrome	440	40		60				
7. Heart based tumour	400	36					60	
8. Mediastinal abscess	295	27	20					
9. Bovine viral leucosis	250	23	40	80	60			80

6. Bovine spongiform encephalopathy

			Veterinarian confidence rating					
Disease	Profile total %		V1	V2	V3	V4	V5	V6
1. Bovine spongiform encephal-opathy	605	43	60	80	40	60		20
2. Brain trauma	545	39	20	40				40
3. Chlorohydro-carbon poisoning	540					40	40	
4. Babesiosis	530	38			60			
5. Selenium poisoning	505	36	40					40
6. Tetanus	490	35		80				
7. Meningitis	425	30	40					
8. Hypomagnes-aemia	29			40				
9. Lead poisoning	365	26	40		40	60		40
10. Encephalitis	335	24					80	
11. Cerebro-cortico-necrosis	325	24			20			
12. Brain neoplasia	325	24	40					
13. Brain abscess	310	22	40					
14. Listeriosis	275	20						20
15. Brain oedema	250	18		60				
16. Heartwater	225	16			40			
17. Rabies	270	19	60					

7. Malignant catarrhal fever

			Veterinarian confidence rating					
Disease	Profile total	%	V1	V2	V3	V4	V5	V6
1. Bovine malignant catarrhal fever	675	48	80	100	80	60	80	80
2. Rinderpest	555	40	40		20			20
3. Oral necro-bacillosis	525	38					80	
4. Mucosal disease	420	30	40		60	60	40	100
5. Blue tongue	320	23						20
6. Foot and mouth	290	21	20	60				
7. Lumpy skin disease	275	20		60				
8. East coast fever	245	18				40		
9. Arsenic poisoning	175	13				60		
10. Infectious bovine rhinio-tracheitis	175	13	40		60			
11. Bovine viral leucosis	120	12	20					
12. Infectious keratocon-junctivitis	120	10		60				

8. Rabies

			Veterinarian confidence rating					
Disease	Profile total	%	V1	V2	V3	V4	V5	V6
1. Rabies	285	41	80		80	80	80	80
2. Meningitis	240	34	20					
3. Organo-phosphorous poisoning	210	30					80	
4. Mercury	170	24				40		
5. Aujeskies disease	170	24				40		
6. Encephalitis	155	22		80		60		
7. Sarcocystis	130	19	20					
8. Botulism	130	19		100				
9. Listeriosis	110	16	20					80
10. Bovine viral diarrhoea	110	16	20					
11. Babesiosis	95	14			60			
12. Heartwater	95	14			80			
13. Brain abscess	70	10		60				
14. Lead poisoning	35	5	40		60		60	
15. Bovine spongiform encephalo-pathy	35	5	40				40	

9. **Ephemeral fever**

			Veterinarian confidence rating					
Disease	Profile total	%	V1	V2	V3	V4	V5	V6
1. Ephemeral fever	425	71	40	100	80	80	80	
2. Black quarter	380	63	40					
3. Pasteurell-osis	380	63				60		
4. Traumatic reticulo-pericarditis	370	62	60		60			
5. Acidosis	360	60						80
6. Enzootic pneumonia	235	39			60			
7. Tetanus	210	35	20					
8. Encephalitis	205	34	40					
9. Peritonitis	180	30		80				
10. Toxoplasmosis	165	28	20					
11. Blue tongue	110	18				40		
12. Pyelo-nephritis	100	17	20					
13. Spondylitis	75	12	20					
14. Sinal injury	65	11	40					
15. Polyarthritis	60	10	20					

10. Mucosal disease

			Veterinarian confidence rating					
Disease	Profile total	%	V1	V2	V3	V4	V5	V6
1. Mucosal disease	330	55	20		60	60		
2. Nephrosis	250	28			60	60		60
3. Rinderpest	195	22				40		
4. Salmonellosis	190	21						40
5. Bovine malignant catarrh	180	20	20			20		
6. Intussception	175	19		40				
7. Ergot poisoning	165	18	20					
8. Arsenic poisoning	145	16				60		
9. Bovine viral leucosis	145	16			20			
10. Mercury poisoning	120	13	20	60				
11. Foot and mouth	105	11	20		40			
12. Mucormycosis	70	8					60	
13. Oral necro-bacillosis	10	1					60	

11. Bovine valvular endocarditis

			Veterinarian confidence rating					
Disease	Profile total	%	V1	V2	V3	V4	V5	V6
1.Traumatic reticulo-pericarditis	260	87	60	60	40	80		80
2.Cor pulmonale	240	80	40					
3.Monensin poisoning	235	78	40					
4.Brisket disease	210	70	60		60	80	60	
5.Cardio-myopathy	215	72	40					
6.Vegetative endocarditis	200	67	40	80	60	80		
7.Caudal vena caval syndrome	195	65	20					
8.Sporadic bovine leucosis	170	57			60			
9.Bovine viral leucosis	150	50	60		60			
10.Facioliasis	10	3		40				

12. Sporadic bovine leucosis

			Veterinarian confidence rating					
Disease	Profile total	%	V1	V2	V3	V4	V5	V6
1. Sporadic bovine leucosis	225	50	60	100	100		80	60
2. Bovine viral leucosis	205	41				60		
3. Vagal indigestion	145	29		60				
4. Tuberculosis	140	28				60		
5. Intestinal neoplasia	120	24				60		
6. Endocarditis	105	21	20					
7. Caudal vena caval syndrome	85	17	40					
8. Hepatitis	80	16						60
9. Hepatic abscess	70	14				60		
10. Facioliasis	70	14				40		
11. Infectious necrotic abscess	60	11	20					

13. Bovine ketosis

			Veterinarian confidence rating					
Disease	Profile total	%	V1	V2	V3	V4	V5	V6
1.Ketosis	390	98	80	40	80	80	80	
2.Fat cow syndome	325	81				80		100
3.Left displaced abomasum	255	64	60		60	40		80
4.Starvation	315	79	60	60				
5.Traumatic pericardo-reticulitis	125	31	40		60			
6.Metritis	120	30	40					

14. Lead poisoning

					Veterinarian confidence rating			
Disease	Profile total	%	V1	V2	V3	V4	V5	V6
1. Lead poisoning	270	45	60	60	60	40		60
2. Bovine malignant catarrh	215	36					80	
3. Heartwater	180	30				40	60	80
4. Hypo-magesaemia	170	28			40	40		
5. Cerebro-cortico-necrosis	145	24	20	100		40		
6. Brain oedema	145	24					80	
7. Hydro-cephalus	125	21				20		
8. Tetanus	130	21						80
9. Meningitis	125	21	20			60		
10. Chloro-hydrocarbon poisoning	120	20	20					
11. Coernurus cerebralis	120	20	40		20	40	80	
12. Salt poisoning	115	19				60		
13. Listeriosis	100	17	20				60	
14. Brain abscess	100	17	20				80	
15. Rabies	95	16	60		40	60	60	
16. Botulism	80	13		20				
17. Brain neoplasia	80	13	20			40	80	

					Veterinarian confidence rating			
Disease	Profile total	%	V1	V2	V3	V4	V5	V6
18. Vitamin A deficiency	55	9	40					

15. Traumatic reticulo-pericarditis

					Veterinarian confidence rating			
Disease	Profile total	%	V1	V2	V3	V4	V5	V6
1. Traumatic reticulo-pericarditis	535	54	100	100	100	100	80	80
2. Endocarditis	495	50		60				
3. Cardiac bovine leucosis	430	43			60			

16. Pyrexia, pruritis and haemorrhage

			Veterinarian confidence rating					
Disease	Profile total	%	V1	V2	V3	V4	V5	V6
1. Pyrexia pruritus haemorrhage	335	68	80		80	60		
2. Louse	190	38					40	40
3. Sarcoptic mange	190	38			40			
4. Aujeskies disease	170	34				40		
5. Sweating sickness	145	29		40	40	40		40
6. Psoroptic mange	145	29			40		40	40
7. Copper deficiency	75	15		80		40		
8. Lumpy skin disease	50	10					60	60
9. Mercury poisoning	40	8	60			20		
10. Arsenic poisoning	30	6	20			60		
11. Bunostomiasis	5	1					80	

17. Post parturient paresis

			Veterinarian confidence rating					
Disease	Profile total	%	V1	V2	V3	V4	V5	V6
1. Post parturient paresis	570	57	80	100	100	100	80	100
2. Snake bite	215	22		60				
3. Coliform mastitis	195	22	60		60			

18. Copper deficiency

			Veterinarian confidence rating					
Disease	Profile total	%	V1	V2	V3	V4	V5	V6
1. Copper deficiency	225	45	60	80	100	60		
2. Cobalt deficiency	215	43			40			
3. Aphosphorosis	170	34					80	
4. Polyarthritis	150	30						60
5. Ephemeral fever	100	20	60					80
6. Foot rot	70	14						40
7. Fluorosis	70	14				20		
8. Haemophilus septicaemia	60	12		60				
9. Nephrosis	50	10				40		
10. Hypocalcaemia	10	2		40				

APPENDIX 4

B.S.E. database.

Sign frequencies within conditions

Condition prevalence

* * * Common
* * Encountered fairly frequently
* Occasionally seen
Rare

1.ARSENIC

Frequency(%)	Signs
20	3. BLINDNESS
20	11. MUSCLE TREMORS
50	13. STAGGERING\DIFFICULTY WALKING
95	14. WEIGHT LOSS

Total number of signs 4

* 2.BLACK LEG

Frequency(%)	Signs
50	11. MUSCLE TREMORS
95	13. STAGGERING\DIFFICULTY WALKING

Total number of signs 2

3.BRAIN ABSCESS

Frequency(%)	Signs
50	2. APPREHENSION\NERVOUS
95	3. BLINDNESS
5	4. CIRCLING
50	7. FRENZY
30	8. HEAD PRESSING
5	11. MUSCLE TREMORS
95	12. SICK 2 WEEKS OR MORE
50	13. STAGGERING\DIFFICULTY WALKING

Total number of signs 8

4.BRAIN TUMOUR

Frequency(%)	Signs
30	3. BLINDNESS
50	4. CIRCLING
70	5. EXAGGERATED RESPONSES
30	6. FALLING
70	8. HEAD PRESSING
5	11. MUSCLE TREMORS
70	12. SICK 2 WEEKS OR MORE
70	13. STAGGERING\DIFFICULTY WALKING
30	14. WEIGHT LOSS

Total number of signs 9

* 5.B.M.C.

Frequency(%)	Signs
30	2. APPREHENSION\NERVOUS
5	4. CIRCLING
50	6. FALLING
20	7. FRENZY
50	11. MUSCLE TREMORS
50	13. STAGGERING\DIFFICULTY WALKING
50	14. WEIGHT LOSS

Total number of signs 7

* 6.BOTULISM

Frequency(%)	Signs
10	3. BLINDNESS
95	11. MUSCLE TREMORS
5	12. SICK 2 WEEKS OR MORE
20	13. STAGGERING\DIFFICULTY WALKING

Total number of signs 4

* * * 7.B.S.E

Frequency(%)	Signs
65	1. ABNORMAL HEAD\EAR POSITION
85	2. APPREHENSION\NERVOUS
1	3. BLINDNESS
1	4. CIRCLING
80	5. EXAGGERATED RESPONSES
35	6. FALLING
30	7. FRENZY
16	8. HEAD PRESSING
50	9. KICKING IN PARLOUR
45	10. LICKING\BITING
70	11. MUSCLE TREMORS
95	12. SICK 2 WEEKS OR MORE
80	13. STAGGERING\DIFFICULTY WALKING
80	14. WEIGHT LOSS

Total number of signs 14

8.B.V.L.

Frequency(%)	Signs
95	12. SICK 2 WEEKS OR MORE
70	13. STAGGERING\DIFFICULTY WALKING
70	14. WEIGHT LOSS

Total number of signs 3

* * 9.CCN

Frequency(%) Signs

50	1. ABNORMAL HEAD\EAR POSITION
95	3. BLINDNESS
5	7. FRENZY
50	8. HEAD PRESSING
5	12. SICK 2 WEEKS OR MORE
95	13. STAGGERING\DIFFICULTY WALKING
70	14. WEIGHT LOSS

Total number of signs 7

10.CYANIDE

Frequency(%)	Signs
20	5. EXAGGERATED RESPONSES
50	11. MUSCLE TREMORS
50	13. STAGGERING\DIFFICULTY WALKING

Total number of signs 3

11.ERGOT

Frequency(%)	Signs
50	2. APPREHENSION\NERVOUS
20	3. BLINDNESS
40	5. EXAGGERATED RESPONSES
30	7. FRENZY
60	11. MUSCLE TREMORS
60	13. STAGGERING\DIFFICULTY WALKING

Total number of signs 6

* 12.FAT COW SYNDROME

Frequency(%)	Signs
70	11. MUSCLE TREMORS
30	12. SICK 2 WEEKS OR MORE
30	14. WEIGHT LOSS

Total number of signs 3

13.FLUORINE

Frequency(%)	Signs
50	5. EXAGGERATED RESPONSES
50	11. MUSCLE TREMORS
5	13. STAGGERING\DIFFICULTY WALKING

Total number of signs 3

14.FURIZOLIDONE

Frequency(%)	Signs
90	5. EXAGGERATED RESPONSES

70 13. STAGGERING\DIFFICULTY WALKING

Total number of signs 2

15.GID

Frequency(%)	Signs
10	1. ABNORMAL HEAD\EAR POSITION
50	3. BLINDNESS
95	4. CIRCLING
70	6. FALLING
70	8. HEAD PRESSING
20	11. MUSCLE TREMORS
70	12. SICK 2 WEEKS OR MORE
80	13. STAGGERING\DIFFICULTY WALKING
10	14. WEIGHT LOSS

Total number of signs 9

* 16.HAEMOPHILUS

Frequency(%)	Signs
50	3. BLINDNESS
30	6. FALLING
95	11. MUSCLE TREMORS
50	13. STAGGERING\DIFFICULTY WALKING
30	14. WEIGHT LOSS

Total number of signs 5

17.HEMLOCK

Frequency(%)	Signs
40	5. EXAGGERATED RESPONSES
70	11. MUSCLE TREMORS
90	13. STAGGERING\DIFFICULTY WALKING

Total number of signs 3

* * * 18.HYPOMAGNESAEMIA

Frequency(%)	Signs
50	2. APPREHENSION\NERVOUS
95	5. EXAGGERATED RESPONSES
30	6. FALLING
5	7. FRENZY
50	9. KICKING IN PARLOUR
70	11. MUSCLE TREMORS
80	13. STAGGERING\DIFFICULTY WALKING

Total number of signs 7

* * * 19.KETOSIS (NERVOUS)

Frequency(%) Signs

30	3. BLINDNESS
50	4. CIRCLING
70	5. EXAGGERATED RESPONSES
5	6. FALLING
30	8. HEAD PRESSING
30	9. KICKING IN PARLOUR
70	10. LICKING\BITING
40	13. STAGGERING\DIFFICULTY WALKING
20	14. WEIGHT LOSS

Total number of signs 9

* * * 20.KETOSIS (WASTING)

Frequency(%)	Signs
30	9. KICKING IN PARLOUR
30	12. SICK 2 WEEKS OR MORE
95	14. WEIGHT LOSS

Total number of signs 3

* 21.LABERNUM

Frequency(%)	Signs
70	5. EXAGGERATED RESPONSES
70	13. STAGGERING\DIFFICULTY WALKING

Total number of signs 2

* * 22.LAMINITIS

Frequency(%)	Signs
30	12. SICK 2 WEEKS OR MORE
95	13. STAGGERING\DIFFICULTY WALKING
30	14. WEIGHT LOSS

Total number of signs 3

* * 23.LEAD (CHRONIC)

Frequency(%)	Signs
95	3. BLINDNESS
30	4. CIRCLING
5	5. EXAGGERATED RESPONSES
5	8. HEAD PRESSING
40	9. KICKING IN PARLOUR
5	11. MUSCLE TREMORS
30	13. STAGGERING\DIFFICULTY WALKING
30	14. WEIGHT LOSS

Total number of signs 8

* * 24.LEAD (ACUTE)

Frequency(%)	Signs
95	3. BLINDNESS
70	5. EXAGGERATED RESPONSES
50	7. FRENZY
5	8. HEAD PRESSING
30	9. KICKING IN PARLOUR
70	11. MUSCLE TREMORS
95	13. STAGGERING\DIFFICULTY WALKING

Total number of signs 7

25.LEVAMIZOLE

Frequency(%)	Signs
80	5. EXAGGERATED RESPONSES
50	7. FRENZY
70	8. HEAD PRESSING
60	10. LICKING\BITING

Total number of signs 4

* * 26.LISTERIOSIS

Frequency(%)	Signs
60	1. ABNORMAL HEAD\EAR POSITION
40	2. APPREHENSION\NERVOUS
50	3. BLINDNESS
30	4. CIRCLING
30	6. FALLING
50	8. HEAD PRESSING
5	11. MUSCLE TREMORS
5	12. SICK 2 WEEKS OR MORE
50	13. STAGGERING\DIFFICULTY WALKING
30	14. WEIGHT LOSS

Total number of signs 10

* 27.LOUPING ILL

Frequency(%)	Signs
50	5. EXAGGERATED RESPONSES
50	11. MUSCLE TREMORS
50	13. STAGGERING\DIFFICULTY WALKING

Total number of signs 3

* * * 28.LICE

Frequency(%)	Signs
95	10. LICKING\BITING
95	12. SICK 2 WEEKS OR MORE

Total number of signs 2

* 29.MENINGITIS

Frequency(%)	Signs
30	3. BLINDNESS
30	5. EXAGGERATED RESPONSES
50	11. MUSCLE TREMORS
5	12. SICK 2 WEEKS OR MORE
95	13. STAGGERING\DIFFICULTY WALKING
5	14. WEIGHT LOSS

Total number of signs 6

30.MERCURY

Frequency(%)	Signs
30	3. BLINDNESS
50	5. EXAGGERATED RESPONSES
30	10. LICKING\BITING
20	11. MUSCLE TREMORS
30	12. SICK 2 WEEKS OR MORE
70	13. STAGGERING\DIFFICULTY WALKING
95	14. WEIGHT LOSS

Total number of signs 7

31.METALDEHYDE

Frequency(%)	Signs
50	3. BLINDNESS
50	5. EXAGGERATED RESPONSES
70	11. MUSCLE TREMORS
70	13. STAGGERING\DIFFICULTY WALKING

Total number of signs 4

* 32.MILK ALLERGY

Frequency(%)	Signs
5	5. EXAGGERATED RESPONSES
10	7. FRENZY
70	10. LICKING\BITING
50	11. MUSCLE TREMORS
30	13. STAGGERING\DIFFICULTY WALKING

Total number of signs 5

* * * 33.MILK FEVER

Frequency(%)	Signs
40	2. APPREHENSION\NERVOUS
80	5. EXAGGERATED RESPONSES
40	6. FALLING
30	9. KICKING IN PARLOUR
80	11. MUSCLE TREMORS
80	13. STAGGERING\DIFFICULTY WALKING

Total number of signs 6

* * 34.OESOPHAGEAL OBSTRUCTION

Frequency(%)	Signs
20	1. ABNORMAL HEAD\EAR POSITION
50	7. FRENZY

Total number of signs 2

35.ORGANOPHOSPHEROUS.

Frequency(%)	Signs
70	11. MUSCLE TREMORS
70	13. STAGGERING\DIFFICULTY WALKING

Total number of signs 2

36.ORGANOCHLORIDE.

Frequency(%)	Signs
70	2. APPREHENSION\NERVOUS
50	5. EXAGGERATED RESPONSES
20	7. FRENZY
50	11. MUSCLE TREMORS
60	13. STAGGERING\DIFFICULTY WALKING

Total number of signs 5

* 37.OTITIS

Frequency(%)	Signs
95	1. ABNORMAL HEAD\EAR POSITION
100	4. CIRCLING
10	6. FALLING
95	12. SICK 2 WEEKS OR MORE
20	13. STAGGERING\DIFFICULTY WALKING
30	14. WEIGHT LOSS

Total number of signs 6

38.OXALATE

Frequency(%)	Signs
80	5. EXAGGERATED RESPONSES
40	6. FALLING
80	11. MUSCLE TREMORS
80	13. STAGGERING\DIFFICULTY WALKING
50	14. WEIGHT LOSS

Total number of signs 5

39.PENICILLIN ALLERGY

Frequency(%)	Signs
50	10. LICKING\BITING

Total number of signs 1

* * 40.PSOROPTIC MANGE

Frequency(%)	Signs
50	10. LICKING\BITING
95	12. SICK 2 WEEKS OR MORE

Total number of signs 2

* 41.P.P.H.

Frequency(%)	Signs
95	10. LICKING\BITING
50	12. SICK 2 WEEKS OR MORE
70	14. WEIGHT LOSS

Total number of signs 3

* 42.RAGWORT

Frequency(%)	Signs
20	3. BLINDNESS
20	7. FRENZY
20	8. HEAD PRESSING
30	13. STAGGERING\DIFFICULTY WALKING
70	14. WEIGHT LOSS

Total number of signs 5

* * 43.SARCOPTIC MANGE

Frequency(%)	Signs
95	10. LICKING\BITING
95	12. SICK 2 WEEKS OR MORE

Total number of signs 2

44.SALT

Frequency(%)	Signs
10	6. FALLING
50	11. MUSCLE TREMORS
50	13. STAGGERING\DIFFICULTY WALKING
70	14. WEIGHT LOSS

Total number of signs 4

45.SELENIUM

Frequency(%)	Signs
50	3. BLINDNESS
20	4. CIRCLING
20	8. HEAD PRESSING
50	13. STAGGERING\DIFFICULTY WALKING
50	14. WEIGHT LOSS

Total number of signs 5

* 46.SPINE INJURY

Frequency(%)	Signs
95	13. STAGGERING\DIFFICULTY WALKING

Total number of signs 1

47.STRYCHNINE

Frequency(%)	Signs
95	5. EXAGGERATED RESPONSES
30	11. MUSCLE TREMORS
30	13. STAGGERING\DIFFICULTY WALKING

Total number of signs 3

* 48.TETANUS

Frequency(%)	Signs
95	5. EXAGGERATED RESPONSES
50	6. FALLING
50	11. MUSCLE TREMORS
10	12. SICK 2 WEEKS OR MORE
95	13. STAGGERING\DIFFICULTY WALKING
70	14. WEIGHT LOSS

Total number of signs 6

49.TOXOPLASMOSIS

Frequency(%)	Signs
50	5. EXAGGERATED RESPONSES
70	13. STAGGERING\DIFFICULTY WALKING

Total number of signs 2

50.TRANSIT TETANY

Frequency(%)	Signs
95	5. EXAGGERATED RESPONSES
50	6. FALLING

50 13. STAGGERING\DIFFICULTY WALKING

Total number of signs 3

* 51.UREA

Frequency(%)	Signs
50	11. MUSCLE TREMORS
70	13. STAGGERING\DIFFICULTY WALKING

Total number of signs 2

52.VITAMIN A D OVERDOSE

Frequency(%)	Signs
70	3. BLINDNESS
10	5. EXAGGERATED RESPONSES
5	6. FALLING
5	8. HEAD PRESSING
95	12. SICK 2 WEEKS OR MORE
50	13. STAGGERING\DIFFICULTY WALKING
30	14. WEIGHT LOSS

Total number of signs 7

53.WATER DEPRIVATIION

Frequency(%)	Signs
50	7. FRENZY
5	11. MUSCLE TREMORS
70	13. STAGGERING\DIFFICULTY WALKING
70	14. WEIGHT LOSS

Total number of signs 4

54.WATER INTOXICATION

Frequency(%)	Signs
10	6. FALLING
50	11. MUSCLE TREMORS
50	13. STAGGERING\DIFFICULTY WALKING

Total number of signs 3

* 55.YEW

Frequency(%)	Signs
50	11. MUSCLE TREMORS
50	13. STAGGERING\DIFFICULTY WALKING

Total number of signs 2

APPENDIX 5

B.S.E database prototypes: Analysis by pattern matching models 1,2,3, and 4.

1. ARSENIC

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

11. MUSCLE TREMORS
13. STAGGERING\DIFFICULTY WALKING
14. WEIGHT LOSS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	230
2	*	48.TETANUS	215
3		38.OXALATE	210
4		30.MERCURY	185
5	*	16.HAEMOPH	175
6		44.SALT	170
7		1.ARSENIC	165
8	* *	9.CCN	165
9	* *	24.LEAD AC	165
10		17.HEMLOCK	160

* * * 7.B.S.E Profile total 230 Ranked number 1

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	230
2	*	48.TETANUS	215
3		38.OXALATE	210
4		30.MERCURY	185
5	*	16.HAEMOPH	175
6		44.SALT	170
7		1.ARSENIC	165
8	*	5.B.M.C.	150
9	*	29.MENINGI	150
10		53.WATER D	145

* * * 7.B.S.E Profile total 230 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1		44.SALT	1260
2		35.ORGANOP.	1240
3	*	6.BOTULIS	1200
4	*	55.YEW	1200
5	*	16.HAEMOPH	1195
6	* *	22.LAMINIT	1195
7	*	46.SPINE I	1195
8		53.WATER D	1195
9		38.OXALATE	1190
10		54.WATER I	1190

* * * 7.B.S.E Profile total 827 Ranked number 54

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1		44.SALT	1260
2	*	16.HAEMOPH	1195
3		53.WATER D	1195
4		38.OXALATE	1190
5	*	29.MENINGI	1185
6	*	48.TETANUS	1160
7	*	5.B.M.C.	1145
8		30.MERCURY	1145
9		1.ARSENIC	1135
10	* *	23.LEAD CH	990

* * * 7.B.S.E Profile total 827 Ranked number 14

2. BLACKLEG

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

11. MUSCLE TREMORS
13. STAGGERING\DIFFICULTY WALKING

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* *	24.LEAD AC	165
2		17.HEMLOCK	160

3	* * *	33.MILK FE	160
4		38.OXALATE	160
5	* * *	7.B.S.E	150
6	* * *	18.HYPOMAG	150
7	*	2.BLACK L	145
8	*	16.HAEMOPH	145
9	*	29.MENINGI	145
10	*	48.TETANUS	145

* * * 7.B.S.E Profile total 150 Ranked number 5

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* *	24.LEAD AC	165
2		17.HEMLOCK	160
3	* * *	33.MILK FE	160
4		38.OXALATE	160
5	* * *	7.B.S.E	150
6	* * *	18.HYPOMAG	150
7	*	2.BLACK L	145
8	*	16.HAEMOPH	145
9	*	29.MENINGI	145
10	*	48.TETANUS	145

* * * 7.B.S.E Profile total 150 Ranked number 5

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1		35.ORGANOP.	1340
2	*	6.BOTULIS	1300
3	*	55.YEW	1300
4	*	46.SPINE I	1295
5		54.WATER I	1290
6		10.CYANIDE	1280
7	*	29.MENINGI	1275
8	*	2.BLACK L	1265
9	*	27.LOUPING	1250
10		31.METALDE	1240

* * * 7.B.S.E Profile total 767 Ranked number 55

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1		35.ORGANOP.	1340
2	*	6.BOTULIS	1300
3	*	55.YEW	1300
4		54.WATER I	1290
5		10.CYANIDE	1280
6	*	29.MENINGI	1275

7	*	2.BLACK L	1265
8	*	27.LOUPING	1250
9		31.METALDE	1240
10	*	51.UREA	1240

* * * 7.B.S.E Profile total 767 Ranked number 33

3. BRAIN ABSCESS

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

2. APPREHENSION\NERVOUS
3. BLINDNESS
7. FRENZY
12. SICK 2 WEEKS OR MORE
13. STAGGERING\DIFFICULTY WALKING

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1		3.BRAIN A	340
2	* * *	7.B.S.E	291
3	* *	24.LEAD AC	240
4		52.VIT A D	215
5	* *	9.CCN	200
6		15.GID	200
7		4.BRAIN T	170
8		8.B.V.L.	165
9		11.ERGOT	160
10		17.HEMLOCK	160

* * * 7.B.S.E Profile total 291 Ranked number 2

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1		3.BRAIN A	340
2	* * *	7.B.S.E	291

* * * 7.B.S.E Profile total 291 Ranked number 2

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1		3.BRAIN A	1200
2		52.VIT A D	1065
3		8.B.V.L.	995
4	* *	22.LAMINIT	995
5	*	46.SPINE I	995
6	* *	24.LEAD AC	965
7		11.ERGOT	960
8		36.ORGANOC.	950
9	*	29.MENINGI	945
10	* *	40.P.MANGE	945

* * * 7.B.S.E Profile total 749 Ranked number 49

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1		3.BRAIN A	1200
2	* * *	7.B.S.E	749

* * * 7.B.S.E Profile total 749 Ranked number 2

4. BRAIN TUMOUR

Condition prevalence

The conditions are classified according to their
relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

4. CIRCLING
5. EXAGGERATED RESPONSES
8. HEAD PRESSING
12. SICK 2 WEEKS OR MORE
13. STAGGERING\DIFFICULTY WALKING

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1		4.BRAIN T	330
2		15.GID	315
3	* * *	7.B.S.E	272
4	*	37.OTITIS	215
5	*	48.TETANUS	200
6	* * *	19.KETOSIS	190

7		3.BRAIN A	180
8	* * *	18.HYPOMAG	175
9	* *	24.LEAD AC	170
10		8.B.V.L.	165

* * * 7.B.S.E Profile total 272 Ranked number 3

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1		4.BRAIN T	330
2	* * *	7.B.S.E	272

* * * 7.B.S.E Profile total 272 Ranked number 2

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1		4.BRAIN T	1135
2		14.FURIZOL	1060
3		15.GID	1055
4	*	21.LABERNU	1040
5		49.TOXOPLA	1020
6		8.B.V.L.	995
7	* *	22.LAMINIT	995
8	*	46.SPINE I	995
9		47.STRYCHN	995
10	*	37.OTITIS	980

* * * 7.B.S.E Profile total 711 Ranked number 55

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1		4.BRAIN T	1135
2	* * *	7.B.S.E	711

* * * 7.B.S.E Profile total 711 Ranked number 2

5. BOVINE MALIGNANT CATARRH

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

6. FALLING
11. MUSCLE TREMORS
13. STAGGERING\DIFFICULTY WALKING
14. WEIGHT LOSS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	265
2	*	48.TETANUS	265
3		38.OXALATE	250
4	*	16.HAEMOPH	205
5	*	5.B.M.C.	200
6	* * *	33.MILK FE	200
7		30.MERCURY	185
8		15.GID	180
9	* * *	18.HYPOMAG	180
10		44.SALT	180

* * * 7.B.S.E Profile total 265 Ranked number 1

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	265
2	*	48.TETANUS	265
3		38.OXALATE	250
4	*	16.HAEMOPH	205
5	*	5.B.M.C.	200
6		15.GID	180
7		44.SALT	180
8		4.BRAIN T	135
9	* *	26.LISTERI	115

* * * 7.B.S.E Profile total 265 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1		44.SALT	1180
2		38.OXALATE	1170
3	*	48.TETANUS	1160
4	*	16.HAEMOPH	1155
5	*	5.B.M.C.	1145
6		35.ORGANOP.	1140
7		54.WATER I	1110
8	*	6.BOTULIS	1100
9	*	55.YEW	1100
10	* *	22.LAMINIT	1095

* * * 7.B.S.E Profile total 797 Ranked number 50

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank	Condition	Sum of PPFs
1	44.SALT	1180
2	38.OXALATE	1170
3	* 48.TETANUS	1160
4	* 16.HAEMOPH	1155
5	* 5.B.M.C.	1145
6	15.GID	885
7	* * 26.LISTERI	880
8	4.BRAIN T	845
9	* * * 7.B.S.E	797

* * * 7.B.S.E Profile total 797 Ranked number 9

6. BOTULISM

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

11. MUSCLE TREMORS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank	Condition	Sum of PPFs
1	* 6.BOTULIS	95
2	* 16.HAEMOPH	95
3	* * * 33.MILK FE	80
4	38.OXALATE	80
5	* * * 7.B.S.E	70
6	* 12.FAT C.S	70
7	17.HEMLOCK	70
8	* * * 18.HYPOMAG	70
9	* * 24.LEAD AC	70
10	31.METALDE	70

* * * 7.B.S.E Profile total 70 Ranked number 5

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	*	6.BOTULIS	95
2	*	16.HAEMOPH	95
3	* * *	33.MILK FE	80
4		38.OXALATE	80
5	* * *	7.B.S.E	70
6	*	12.FAT C.S	70
7		17.HEMLOCK	70
8	* * *	18.HYPOMAG	70
9	* *	24.LEAD AC	70
10		31.METALDE	70

* * * 7.B.S.E Profile total 70 Ranked number 5

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1	*	6.BOTULIS	1360
2	*	12.FAT C.S	1310
3		35.ORGANOP.	1300
4	*	55.YEW	1300
5		13.FLUORIN	1295
6		54.WATER I	1290
7		10.CYANIDE	1280
8	*	27.LOUPING	1250
9		39.PEN ALL	1250
10	*	16.HAEMOPH	1235

* * * 7.B.S.E Profile total 707 Ranked number 55

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1	*	6.BOTULIS	1360
2	*	12.FAT C.S	1310
3		35.ORGANOP.	1300
4	*	55.YEW	1300
5		13.FLUORIN	1295
6		54.WATER I	1290
7		10.CYANIDE	1280
8	*	27.LOUPING	1250
9	*	16.HAEMOPH	1235
10	*	32.MILK AL	1235

* * * 7.B.S.E Profile total 707 Ranked number 34

7. BOVINE SPONGIFORM ENCEPHALOPATHY

Condition prevalence

The conditions are classified according to their relative prevalences as follows

```
* * * = Common
  * * = Encountered fairly frequently
    * = Occasionaly seen
      = Rare
```

Check list signs observed to be PRESENT

1. ABNORMAL HEAD\EAR POSITION
2. APPREHENSION\NERVOUS
5. EXAGGERATED RESPONSES
9. KICKING IN PARLOUR
11. MUSCLE TREMORS
12. SICK 2 WEEKS OR MORE
13. STAGGERING\DIFFICULTY WALKING
14. WEIGHT LOSS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	605
2	* * *	18.HYPOMAG	415
3	* * *	33.MILK FE	360
4		17.HEMLOCK	340
5	*	48.TETANUS	320
6		38.OXALATE	290
7		1.ARSENIC	275
8	* *	24.LEAD AC	265
9		30.MERCURY	265
10		4.BRAIN T	245

* * * 7.B.S.E Profile total 605 Ranked number 1

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	605

* * * 7.B.S.E Profile total 605 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	1077
2	* * *	18.HYPOMAG	980
3		17.HEMLOCK	940
4	* * *	33.MILK FE	920
5	*	48.TETANUS	870
6		1.ARSENIC	855
7		38.OXALATE	850
8		8.B.V.L.	835
9	*	2.BLACK L	825

10 36.ORGANOC. 810

* * * 7.B.S.E Profile total 1077 Ranked number 1

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	1077

* * * 7.B.S.E Profile total 1077 Ranked number 1

8. BOVINE VIRAL LEUKOSIS

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

12. SICK 2 WEEKS OR MORE
13. STAGGERING\DIFFICULTY WALKING
14. WEIGHT LOSS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	255
2		8.B.V.L.	235
3		1.ARSENIC	195
4		30.MERCURY	195
5	*	48.TETANUS	175
6		52.VIT A D	175
7		4.BRAIN T	170
8	* *	9.CCN	170
9		15.GID	160
10	* *	22.LAMINIT	155

* * * 7.B.S.E Profile total 255 Ranked number 1

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	255
2		8.B.V.L.	235

3		1.ARSENIC	195
4		30.MERCURY	195
5	*	48.TETANUS	175
6		52.VIT A D	175
7		4.BRAIN T	170
8	* *	9.CCN	170
9		15.GID	160
10	* *	22.LAMINIT	155

* * * 7.B.S.E Profile total 255 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1		8.B.V.L.	1335
2	* *	22.LAMINIT	1255
3		1.ARSENIC	1195
4	* * *	20.KETOSIS	1195
5	*	46.SPINE I	1195
6		52.VIT A D	1185
7		53.WATER D	1185
8		30.MERCURY	1165
9		44.SALT	1160
10	* *	40.P.MANGE	1145

* * * 7.B.S.E Profile total 877 Ranked number 50

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1		8.B.V.L.	1335
2	* *	22.LAMINIT	1255
3		1.ARSENIC	1195
4		52.VIT A D	1185
5		30.MERCURY	1165
6	*	29.MENINGI	1095
7	*	48.TETANUS	1080
8	* *	9.CCN	1070
9	*	37.OTITIS	1040
10		4.BRAIN T	1015

* * * 7.B.S.E Profile total 877 Ranked number 13

9. CEREBRO CORTICO NECROSIS

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

1. ABNORMAL HEAD\EAR POSITION
3. BLINDNESS
8. HEAD PRESSING
13. STAGGERING\DIFFICULTY WALKING
14. WEIGHT LOSS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* *	9.CCN	360
2	* * *	7.B.S.E	242
3	* *	26.LISTERI	240
4		1.ARSENIC	225
5		15.GID	220
6		4.BRAIN T	200
7	* *	24.LEAD AC	195
8		30.MERCURY	195
9	*	2.BLACK L	175
10		3.BRAIN A	175

* * * 7.B.S.E Profile total 242 Ranked number 2

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* *	9.CCN	360
2	* * *	7.B.S.E	242
3	* *	26.LISTERI	240
4		15.GID	220

* * * 7.B.S.E Profile total 242 Ranked number 2

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1	* *	9.CCN	1250
2		1.ARSENIC	1055
3		45.SELENIU	1050
4	* *	26.LISTERI	1030
5	*	2.BLACK L	1025
6	*	42.RAGWORT	1020
7	*	51.UREA	1000
8	* *	22.LAMINIT	995
9	*	46.SPINE I	995
10		53.WATER D	985

* * * 7.B.S.E Profile total 651 Ranked number 55

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank	Condition	Sum of PPFs
1	* * 9.CCN	1250
2	* * 26.LISTERI	1030
3	15.GID	865
4	* * * 7.B.S.E	651

* * * 7.B.S.E Profile total 651 Ranked number 4

10. CYANIDE

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

11. MUSCLE TREMORS
13. STAGGERING\DIFFICULTY WALKING

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank	Condition	Sum of PPFs
1	* * 24.LEAD AC	165
2	17.HEMLOCK	160
3	* * * 33.MILK FE	160
4	38.OXALATE	160
5	* * * 7.B.S.E	150
6	* * * 18.HYPOMAG	150
7	* 2.BLACK L	145
8	* 16.HAEMOPH	145
9	* 29.MENINGI	145
10	* 48.TETANUS	145

* * * 7.B.S.E Profile total 150 Ranked number 5

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank	Condition	Sum of PPFs
1	* * 24.LEAD AC	165
2	17.HEMLOCK	160
3	* * * 33.MILK FE	160
4	38.OXALATE	160
5	* * * 7.B.S.E	150

6	* * *	18.HYPOMAG	150
7	*	2.BLACK L	145
8	*	16.HAEMOPH	145
9	*	29.MENINGI	145
10	*	48.TETANUS	145

* * * 7.B.S.E Profile total 150 Ranked number 5

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1		35.ORGANOP.	1340
2	*	6.BOTULIS	1300
3	*	55.YEW	1300
4	*	46.SPINE I	1295
5		54.WATER I	1290
6		10.CYANIDE	1280
7	*	29.MENINGI	1275
8	*	2.BLACK L	1265
9	*	27.LOUPING	1250
10		31.METALDE	1240

* * * 7.B.S.E Profile total 767 Ranked number 55

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1		35.ORGANOP.	1340
2	*	6.BOTULIS	1300
3	*	55.YEW	1300
4		54.WATER I	1290
5		10.CYANIDE	1280
6	*	29.MENINGI	1275
7	*	2.BLACK L	1265
8	*	27.LOUPING	1250
9		31.METALDE	1240
10	*	51.UREA	1240

* * * 7.B.S.E Profile total 767 Ranked number 33

11 ERGOT

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

2. APPREHENSION\NERVOUS
5. EXAGGERATED RESPONSES
11. MUSCLE TREMORS
13. STAGGERING\DIFFICULTY WALKING

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	315
2	* * *	18.HYPOMAG	295
3	* * *	33.MILK FE	280
4		17.HEMLOCK	270
5		38.OXALATE	240
6	*	48.TETANUS	240
7	* *	24.LEAD AC	235
8		36.ORGANOC.	230
9		11.ERGOT	210
10		31.METALDE	190

* * * 7.B.S.E Profile total 315 Ranked number 1

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	315
2	* * *	18.HYPOMAG	295
3	* * *	33.MILK FE	280
4		17.HEMLOCK	270
5		36.ORGANOC.	230
6		11.ERGOT	210

* * * 7.B.S.E Profile total 315 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1		36.ORGANOC.	1210
2		17.HEMLOCK	1200
3		11.ERGOT	1160
4		14.FURIZOL	1160
5	* * *	33.MILK FE	1160
6		47.STRYCHN	1155
7	*	27.LOUPING	1150
8		38.OXALATE	1150
9	* * *	18.HYPOMAG	1140
10	*	21.LABERNU	1140

* * * 7.B.S.E Profile total 897 Ranked number 40

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1		36.ORGANOC.	1210
2		17.HEMLOCK	1200
3		11.ERGOT	1160
4	* * *	33.MILK FE	1160
5	* * *	18.HYPOMAG	1140
6	* * *	7.B.S.E	897

* * * 7.B.S.E Profile total 897 Ranked number 6

12 FAT COW SYNDROME

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

11. MUSCLE TREMORS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	*	6.BOTULIS	95
2	*	16.HAEMOPH	95
3	* * *	33.MILK FE	80
4		38.OXALATE	80
5	* * *	7.B.S.E	70
6	*	12.FAT C.S	70
7		17.HEMLOCK	70
8	* * *	18.HYPOMAG	70
9	* *	24.LEAD AC	70
10		31.METALDE	70

* * * 7.B.S.E Profile total 70 Ranked number 5

PATTERN MATCHING MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	*	6.BOTULIS	95
2	*	16.HAEMOPH	95
3	* * *	33.MILK FE	80
4		38.OXALATE	80
5	* * *	7.B.S.E	70
6	*	12.FAT C.S	70

7		17.HEMLOCK	70
8	* * *	18.HYPOMAG	70
9	* *	24.LEAD AC	70
10		31.METALDE	70

* * * 7.B.S.E Profile total 70 Ranked number 5

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1	*	6.BOTULIS	1360
2	*	12.FAT C.S	1310
3		35.ORGANOP.	1300
4	*	55.YEW	1300
5		13.FLUORIN	1295
6		54.WATER I	1290
7		10.CYANIDE	1280
8	*	27.LOUPING	1250
9		39.PEN ALL	1250
10	*	16.HAEMOPH	1235

* * * 7.B.S.E Profile total 707 Ranked number 55

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1	*	6.BOTULIS	1360
2	*	12.FAT C.S	1310
3		35.ORGANOP.	1300
4	*	55.YEW	1300
5		13.FLUORIN	1295
6		54.WATER I	1290
7		10.CYANIDE	1280
8	*	27.LOUPING	1250
9	*	16.HAEMOPH	1235
10	*	32.MILK AL	1235

* * * 7.B.S.E Profile total 707 Ranked number 34

13. FLUORINE

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

5. EXAGGERATED RESPONSES

11. MUSCLE TREMORS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	18.HYPOMAG	165
2	* * *	33.MILK FE	160
3		38.OXALATE	160
4	* * *	7.B.S.E	150
5	*	48.TETANUS	145
6	* *	24.LEAD AC	140
7		47.STRYCHN	125
8		31.METALDE	120
9		17.HEMLOCK	110
10		11.ERGOT	100

* * * 7.B.S.E Profile total 150 Ranked number 4

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	18.HYPOMAG	165
2	* * *	33.MILK FE	160
3		38.OXALATE	160
4	* * *	7.B.S.E	150
5	*	48.TETANUS	145
6	* *	24.LEAD AC	140
7		47.STRYCHN	125
8		31.METALDE	120
9		17.HEMLOCK	110
10		11.ERGOT	100

* * * 7.B.S.E Profile total 150 Ranked number 4

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1		13.FLUORIN	1295
2		47.STRYCHN	1295
3	*	6.BOTULIS	1260
4	*	27.LOUPING	1250
5		10.CYANIDE	1220
6		14.FURIZOL	1220
7	*	12.FAT C.S	1210
8	*	21.LABERNU	1200
9		31.METALDE	1200
10		35.ORGANOP.	1200

* * * 7.B.S.E Profile total 767 Ranked number 54

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank	Condition	Sum of PPFs
1	13.FLUORIN	1295
2	47.STRYCHN	1295
3	* 27.LOUPING	1250
4	10.CYANIDE	1220
5	31.METALDE	1200
6	38.OXALATE	1190
7	36.ORGANOC.	1150
8	* 29.MENINGI	1145
9	* 32.MILK AL	1145
10	11.ERGOT	1140

* * * 7.B.S.E Profile total 767 Ranked number 19

14 FURIZOLIDONE

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

5. EXAGGERATED RESPONSES
13. STAGGERING\DIFFICULTY WALKING

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank	Condition	Sum of PPFs
1	* 48.TETANUS	190
2	* * * 18.HYPOMAG	175
3	* * 24.LEAD AC	165
4	* * * 7.B.S.E	160
5	14.FURIZOL	160
6	* * * 33.MILK FE	160
7	38.OXALATE	160
8	50.TR.TET	145
9	4.BRAIN T	140
10	* 21.LABERNU	140

* * * 7.B.S.E Profile total 160 Ranked number 4

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank Condition Sum of PPFs

1	* 48.TETANUS	190
2	* * * 18.HYPOMAG	175
3	* * 24.LEAD AC	165
4	* * * 7.B.S.E	160
5	14.FURIZOL	160
6	* * * 33.MILK FE	160
7	38.OXALATE	160
8	50.TR.TET	145
9	4.BRAIN T	140
10	* 21.LABERNU	140

* * * 7.B.S.E Profile total 160 Ranked number 4

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank	Condition	Sum of PPFs
1	14.FURIZOL	1360
2	* 21.LABERNU	1340
3	49.TOXOPLA	1320
4	* 46.SPINE I	1295
5	47.STRYCHN	1295
6	* 27.LOUPING	1250
7	* * 22.LAMINIT	1235
8	* 29.MENINGI	1235
9	50.TR.TET	1225
10	10.CYANIDE	1220

* * * 7.B.S.E Profile total 787 Ranked number 55

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank	Condition	Sum of PPFs
1	14.FURIZOL	1360
2	* 21.LABERNU	1340
3	49.TOXOPLA	1320
4	47.STRYCHN	1295
5	* 27.LOUPING	1250
6	* 29.MENINGI	1235
7	50.TR.TET	1225
8	10.CYANIDE	1220
9	* 48.TETANUS	1210
10	13.FLUORIN	1205

* * * 7.B.S.E Profile total 787 Ranked number 25

15. GID

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently

* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

3. BLINDNESS
4. CIRCLING
6. FALLING
8. HEAD PRESSING
12. SICK 2 WEEKS OR MORE
13. STAGGERING\DIFFICULTY WALKING

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1		15.GID	435
2		4.BRAIN T	320
3		3.BRAIN A	275
4	* *	9.CCN	245
5	* * *	7.B.S.E	228
6	*	37.OTITIS	225
7		52.VIT A D	225
8	* *	26.LISTERI	215
9	* *	24.LEAD AC	195
10		51.TR.TET	170

* * * 7.B.S.E Profile total 228 Ranked number 5

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1		15.GID	435
2		4.BRAIN T	320
3	* * *	7.B.S.E	228
4	* *	26.LISTERI	215

* * * 7.B.S.E Profile total 228 Ranked number 3

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1		15.GID	1195
2		4.BRAIN T	1015
3		52.VIT A D	985
4		3.BRAIN A	970
5	* *	9.CCN	920
6	*	37.OTITIS	900
7		8.B.V.L.	895
8	* *	22.LAMINIT	895
9	*	46.SPINE I	895
10		45.SELENIU	890

* * * 7.B.S.E Profile total 523 Ranked number 55

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1		15.GID	1195
2		4.BRAIN T	1015
3	* *	26.LISTERI	880
4	* * *	7.B.S.E	523

* * * 7.B.S.E Profile total 523 Ranked number 4

16. HAEMOPHILUS

Condition prevalence

The conditions are classified according to their
relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

3. BLINDNESS
11. MUSCLE TREMORS
13. STAGGERING\DIFFICULTY WALKING

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* *	24.LEAD AC	260
2	*	16.HAEMOPH	195
3	* *	9.CCN	190
4		31.METALDE	190
5	*	29.MENINGI	175
6		17.HEMLOCK	160
7	* * *	33.MILK FE	160
8		38.OXALATE	160
9	* * *	7.B.S.E	151
10		3.BRAIN A	150

* * * 7.B.S.E Profile total 151 Ranked number 9

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* *	24.LEAD AC	260

2	*	16.HAEMOPH	195
3		31.METALDE	190
4	*	29.MENINGI	175
5	* * *	7.B.S.E	151
6		3.BRAIN A	150
7		15.GID	150
8		11.ERGOT	140
9	* *	23.LEAD CH	130
10	*	6.BOTULIS	125

* * * 7.B.S.E Profile total 151 Ranked number 5

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1		31.METALDE	1240
2		35.ORGANOP.	1240
3	*	16.HAEMOPH	1235
4	*	29.MENINGI	1235
5	*	6.BOTULIS	1220
6	* *	24.LEAD AC	1205
7	*	55.YEW	1200
8	*	46.SPINE I	1195
9		54.WATER I	1190
10		10.CYANIDE	1180

* * * 7.B.S.E Profile total 669 Ranked number 55

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1		31.METALDE	1240
2	*	16.HAEMOPH	1235
3	*	29.MENINGI	1235
4	*	6.BOTULIS	1220
5	* *	24.LEAD AC	1205
6		11.ERGOT	1120
7	* *	23.LEAD CH	1120
8		3.BRAIN A	1020
9		30.MERCURY	1015
10		1.ARSENIC	985

* * * 7.B.S.E Profile total 669 Ranked number 14

17. HEMLOCK

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen

= Rare

Check list signs observed to be PRESENT

11. MUSCLE TREMORS
13. STAGGERING\DIFFICULTY WALKING

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* *	24.LEAD AC	165
2		17.HEMLOCK	160
3	* * *	33.MILK FE	160
4		38.OXALATE	160
5	* * *	7.B.S.E	150
6	* * *	18.HYPOMAG	150
7	*	2.BLACK L	145
8	*	16.HAEMOPH	145
9	*	29.MENINGI	145
10	*	48.TETANUS	145

* * * 7.B.S.E Profile total 150 Ranked number 5

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* *	24.LEAD AC	165
2		17.HEMLOCK	160
3	* * *	33.MILK FE	160
4		38.OXALATE	160
5	* * *	7.B.S.E	150
6	* * *	18.HYPOMAG	150
7	*	2.BLACK L	145
8	*	16.HAEMOPH	145
9	*	29.MENINGI	145
10	*	48.TETANUS	145

* * * 7.B.S.E Profile total 150 Ranked number 5

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1		35.ORGANOP.	1340
2	*	6.BOTULIS	1300
3	*	55.YEW	1300
4	*	46.SPINE I	1295
5		54.WATER I	1290
6		10.CYANIDE	1280
7	*	29.MENINGI	1275
8	*	2.BLACK L	1265
9	*	27.LOUPING	1250
10		31.METALDE	1240

* * * 7.B.S.E Profile total 767 Ranked number 55

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank	Condition	Sum of PPFs
1	35.ORGANOP.	1340
2	* 6.BOTULIS	1300
3	* 55.YEW	1300
4	54.WATER I	1290
5	10.CYANIDE	1280
6	* 29.MENINGI	1275
7	* 2.BLACK L	1265
8	* 27.LOUPING	1250
9	31.METALDE	1240
10	* 51.UREA	1240

* * * 7.B.S.E Profile total 767 Ranked number 33

18. HYPOMAGNESAEMIA

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

2. APPREHENSION\NERVOUS
5. EXAGGERATED RESPONSES
11. MUSCLE TREMORS
13. STAGGERING\DIFFICULTY WALKING

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank	Condition	Sum of PPFs
1	* * * 7.B.S.E	315
2	* * * 18.HYPOMAG	295
3	* * * 33.MILK FE	280
4	17.HEMLOCK	270
5	38.OXALATE	240
6	* 48.TETANUS	240
7	* * 24.LEAD AC	235
8	36.ORGANOC.	230
9	11.ERGOT	210
10	31.METALDE	190

* * * 7.B.S.E Profile total 315 Ranked number 1

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	315
2	* * *	18.HYPOMAG	295
3	* * *	33.MILK FE	280
4		17.HEMLOCK	270
5		36.ORGANOC.	230
6		11.ERGOT	210

* * * 7.B.S.E Profile total 315 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1		36.ORGANOC.	1210
2		17.HEMLOCK	1200
3		11.ERGOT	1160
4		14.FURIZOL	1160
5	* * *	33.MILK FE	1160
6		47.STRYCHN	1155
7	*	27.LOUPING	1150
8		38.OXALATE	1150
9	* * *	18.HYPOMAG	1140
10	*	21.LABERNU	1140

* * * 7.B.S.E Profile total 897 Ranked number 40

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1		36.ORGANOC.	1210
2		17.HEMLOCK	1200
3		11.ERGOT	1160
4	* * *	33.MILK FE	1160
5	* * *	18.HYPOMAG	1140
6	* * *	7.B.S.E	897

* * * 7.B.S.E Profile total 897 Ranked number 6

19. KETOSIS (NERVOUS)

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen

= Rare

Check list signs observed to be PRESENT

4. CIRCLING
5. EXAGGERATED RESPONSES
10. LICKING\BITING
13. STAGGERING\DIFFICULTY WALKING

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	19.KETOSIS	230
2	* * *	7.B.S.E	206
3		4.BRAIN T	190
4	*	48.TETANUS	190
5		15.GID	175
6	* * *	18.HYPOMAG	175
7	* *	24.LEAD AC	165
8		14.FURIZOL	160
9	* * *	33.MILK FE	160
10		38.OXALATE	160

* * * 7.B.S.E Profile total 206 Ranked number 2

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	19.KETOSIS	230
2	* * *	7.B.S.E	206

* * * 7.B.S.E Profile total 206 Ranked number 2

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1		14.FURIZOL	1160
2	*	21.LABERNU	1140
3		49.TOXOPLA	1120
4	* * *	19.KETOSIS	1115
5	*	46.SPINE I	1095
6		47.STRYCHN	1095
7	*	27.LOUPING	1050
8		39.PEN ALL	1050
9	*	32.MILK AL	1045
10	* *	22.LAMINIT	1035

* * * 7.B.S.E Profile total 679 Ranked number 55

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	19.KETOSIS	1115
2	* * *	7.B.S.E	679

* * * 7.B.S.E Profile total 679 Ranked number 2

20. KETOSIS (WASTING)

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

14. WEIGHT LOSS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1		1.ARSENIC	95
2	* * *	20.KETOSIS	95
3		30.MERCURY	95
4	* * *	7.B.S.E	80
5		8.B.V.L.	70
6	* *	9.CCN	70
7	*	41.P.P.H.	70
8	*	42.RAGWORT	70
9		44.SALT	70
10	*	48.TETANUS	70

* * * 7.B.S.E Profile total 80 Ranked number 4

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1		1.ARSENIC	95
2	* * *	20.KETOSIS	95
3		30.MERCURY	95
4	* * *	7.B.S.E	80
5		8.B.V.L.	70
6	* *	9.CCN	70
7	*	41.P.P.H.	70
8	*	42.RAGWORT	70
9		44.SALT	70
10	*	48.TETANUS	70

* * * 7.B.S.E Profile total 80 Ranked number 4

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1	* * *	20.KETOSIS	1335
2	*	42.RAGWORT	1280
3		44.SALT	1260
4		39.PEN ALL	1250
5		53.WATER D	1245
6	*	12.FAT C.S	1230
7	* *	34.OES.OBS	1230
8	*	41.P.P.H.	1225
9		45.SELENIU	1210
10		8.B.V.L.	1205

* * * 7.B.S.E Profile total 727 Ranked number 55

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	20.KETOSIS	1335
2	*	42.RAGWORT	1280
3		44.SALT	1260
4		53.WATER D	1245
5	*	12.FAT C.S	1230
6	*	41.P.P.H.	1225
7		45.SELENIU	1210
8		8.B.V.L.	1205
9	* *	22.LAMINIT	1205
10		1.ARSENIC	1195

* * * 7.B.S.E Profile total 727 Ranked number 25

21. LABERNUM

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

5. EXAGGERATED RESPONSES
13. STAGGERING\DIFFICULTY WALKING

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	*	48.TETANUS	190
2	* * *	18.HYPOMAG	175
3	* *	24.LEAD AC	165
4	* * *	7.B.S.E	160
5		14.FURIZOL	160
6	* * *	33.MILK FE	160
7		38.OXALATE	160
8		50.TR.TET	145
9		4.BRAIN T	140
10	*	21.LABERNU	140

* * * 7.B.S.E Profile total 160 Ranked number 4

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	*	48.TETANUS	190
2	* * *	18.HYPOMAG	175
3	* *	24.LEAD AC	165
4	* * *	7.B.S.E	160
5		14.FURIZOL	160
6	* * *	33.MILK FE	160
7		38.OXALATE	160
8		50.TR.TET	145
9		4.BRAIN T	140
10	*	21.LABERNU	140

* * * 7.B.S.E Profile total 160 Ranked number 4

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1		14.FURIZOL	1360
2	*	21.LABERNU	1340
3		49.TOXOPLA	1320
4	*	46.SPINE I	1295
5		47.STRYCHN	1295
6	*	27.LOUPING	1250
7	* *	22.LAMINIT	1235
8	*	29.MENINGI	1235
9		50.TR.TET	1225
10		10.CYANIDE	1220

* * * 7.B.S.E Profile total 787 Ranked number 55

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank Condition Sum of PPFs

1		14.FURIZOL	1360
2	*	21.LABERNU	1340
3		49.TOXOPLA	1320
4		47.STRYCHN	1295
5	*	27.LOUPING	1250
6	*	29.MENINGI	1235
7		50.TR.TET	1225
8		10.CYANIDE	1220
9	*	48.TETANUS	1210
10		13.FLUORIN	1205

* * * 7.B.S.E Profile total 787 Ranked number 25

22. LAMINITIS

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

13. STAGGERING\DIFFICULTY WALKING

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	*	2.BLACK L	95
2	* *	9.CCN	95
3	* *	22.LAMINIT	95
4	* *	24.LEAD AC	95
5	*	29.MENINGI	95
6	*	46.SPINE I	95
7	*	48.TETANUS	95
8		17.HEMLOCK	90
9	* * *	7.B.S.E	80
10		15.GID	80

* * * 7.B.S.E Profile total 80 Ranked number 9

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	*	2.BLACK L	95
2	* *	9.CCN	95
3	* *	22.LAMINIT	95
4	* *	24.LEAD AC	95
5	*	29.MENINGI	95

6	*	46.SPINE I	95
7	*	48.TETANUS	95
8		17.HEMLOCK	90
9	* * *	7.B.S.E	80
10		15.GID	80

* * * 7.B.S.E Profile total 80 Ranked number 9

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1	*	46.SPINE I	1395
2	* *	22.LAMINIT	1335
3		49.TOXOPLA	1320
4	*	21.LABERNU	1300
5		35.ORGANOP.	1300
6	*	55.YEW	1300
7		54.WATER I	1290
8		10.CYANIDE	1280
9		14.FURIZOL	1280
10	*	29.MENINGI	1275

* * * 7.B.S.E Profile total 727 Ranked number 55

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1	*	46.SPINE I	1395
2	* *	22.LAMINIT	1335
3		49.TOXOPLA	1320
4	*	21.LABERNU	1300
5		35.ORGANOP.	1300
6	*	55.YEW	1300
7		54.WATER I	1290
8		10.CYANIDE	1280
9		14.FURIZOL	1280
10	*	29.MENINGI	1275

* * * 7.B.S.E Profile total 727 Ranked number 46

23. LEAD (CHRONIC)

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

3. BLINDNESS
4. CIRCLING
13. STAGGERING\DIFFICULTY WALKING
14. WEIGHT LOSS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* *	9.CCN	260
2		15.GID	235
3		30.MERCURY	195
4	* *	24.LEAD AC	190
5	* *	23.LEAD CH	185
6		4.BRAIN T	180
7		45.SELENIU	170
8		1.ARSENIC	165
9	*	48.TETANUS	165
10	* * *	7.B.S.E	162

* * * 7.B.S.E Profile total 162 Ranked number 10

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1		15.GID	235
2	* *	23.LEAD CH	185
3		4.BRAIN T	180
4		45.SELENIU	170
5	* * *	7.B.S.E	162
6	* *	26.LISTERI	160
7	* * *	19.KETOSIS	140

* * * 7.B.S.E Profile total 162 Ranked number 5

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1	* *	9.CCN	1150
2		45.SELENIU	1150
3	* *	23.LEAD CH	1130
4	* *	22.LAMINIT	1095
5	*	46.SPINE I	1095
6		53.WATER D	1085
7	*	42.RAGWORT	1080
8		30.MERCURY	1065
9		44.SALT	1060
10		8.B.V.L.	1045

* * * 7.B.S.E Profile total 591 Ranked number 55

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1		45.SELENIU	1150
2	* *	23.LEAD CH	1130
3		15.GID	995
4	* *	26.LISTERI	970
5		4.BRAIN T	935
6	* * *	19.KETOSIS	935
7	* * *	7.B.S.E	591

* * * 7.B.S.E Profile total 591 Ranked number 7

24. LEAD (ACUTE)

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

3. BLINDNESS
5. EXAGGERATED RESPONSES
11. MUSCLE TREMORS
13. STAGGERING\DIFFICULTY WALKING

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* *	24.LEAD AC	330
2	* * *	18.HYPOMAG	245
3		31.METALDE	240
4	* * *	33.MILK FE	240
5		38.OXALATE	240
6	*	48.TETANUS	240
7	* * *	7.B.S.E	231
8		50.TR.TET	215
9	*	29.MENINGI	205
10		17.HEMLOCK	200

* * * 7.B.S.E Profile total 231 Ranked number 7

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* *	24.LEAD AC	330

2		31.METALDE	240
3	* * *	7.B.S.E	231
4	*	29.MENINGI	205
5		11.ERGOT	180
6		4.BRAIN T	175
7		30.MERCURY	170
8	* *	23.LEAD CH	135

* * * 7.B.S.E Profile total 231 Ranked number 3

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1	* *	24.LEAD AC	1245
2		31.METALDE	1240
3	*	29.MENINGI	1195
4		50.TR.TET	1165
5		14.FURIZOL	1160
6		47.STRYCHN	1155
7	*	27.LOUPING	1150
8		38.OXALATE	1150
9	*	21.LABERNU	1140
10		35.ORGANOP.	1140

* * * 7.B.S.E Profile total 729 Ranked number 53

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1	* *	24.LEAD AC	1245
2		31.METALDE	1240
3	*	29.MENINGI	1195
4		11.ERGOT	1100
5	* *	23.LEAD CH	1030
6		30.MERCURY	1015
7		4.BRAIN T	925
8	* * *	7.B.S.E	729

* * * 7.B.S.E Profile total 729 Ranked number 8

25. LEVAMIZOLE

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

5. EXAGGERATED RESPONSES
7. FRENZY
8. HEAD PRESSING
10. LICKING\BITING

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1		25.LEVAMIZ	260
2	* * *	7.B.S.E	171
3	* * *	19.KETOSIS	170
4		4.BRAIN T	140
5	* *	24.LEAD AC	125
6	* * *	18.HYPOMAG	100
7	* * *	28.LICE	95
8	*	41.P.P.H.	95
9	* *	43.S.MANGE	95
10		47.STRYCHN	95

* * * 7.B.S.E Profile total 171 Ranked number 2

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1		25.LEVAMIZ	260
2	* * *	7.B.S.E	171

* * * 7.B.S.E Profile total 171 Ranked number 2

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1		25.LEVAMIZ	1260
2		39.PEN ALL	1050
3		47.STRYCHN	1035
4	* *	34.OES.OBS	1030
5		14.FURIZOL	1020
6	*	32.MILK AL	1005
7	*	21.LABERNU	1000
8	* *	43.S.MANGE	1000
9		13.FLUORIN	995
10	* * *	19.KETOSIS	995

* * * 7.B.S.E Profile total 609 Ranked number 55

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank Condition Sum of PPFs

1		25.LEVAMIZ	1260
2	* * *	7.B.S.E	609

* * * 7.B.S.E   Profile total 609   Ranked number 2

26. LISTERIOSIS

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

1. ABNORMAL HEAD\EAR POSITION
3. BLINDNESS
8. HEAD PRESSING
13. STAGGERING\DIFFICULTY WALKING

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* *	9.CCN	290
2		15.GID	210
3	* *	26.LISTERI	210
4	* *	24.LEAD AC	195
5	*	2.BLACK L	175
6		3.BRAIN A	175
7		4.BRAIN T	170
8	* * *	7.B.S.E	162
9		17.HEMLOCK	160
10	* * *	18.HYPOMAG	150

* * * 7.B.S.E   Profile total 162   Ranked number 8

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* *	9.CCN	290
2		15.GID	210
3	* *	26.LISTERI	210
4	* * *	7.B.S.E	162

* * * 7.B.S.E   Profile total 162   Ranked number 4

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1	* *	9.CCN	1210
2	*	2.BLACK L	1125
3	*	51.UREA	1100
4	*	46.SPINE I	1095
5	* *	26.LISTERI	1070
6		45.SELENIU	1050
7	* *	22.LAMINIT	1035
8	*	29.MENINGI	1035
9	* *	23.LEAD CH	1020
10		49.TOXOPLA	1020

* * * 7.B.S.E Profile total 591 Ranked number 55

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1	* *	9.CCN	1210
2	* *	26.LISTERI	1070
3		15.GID	945
4	* * *	7.B.S.E	591

* * * 7.B.S.E Profile total 591 Ranked number 4

27. LOUPING ILL

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

5. EXAGGERATED RESPONSES
11. MUSCLE TREMORS
13. STAGGERING\DIFFICULTY WALKING

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	18.HYPOMAG	245
2	* * *	33.MILK FE	240
3		38.OXALATE	240
4	*	48.TETANUS	240
5	* *	24.LEAD AC	235
6	* * *	7.B.S.E	230
7		17.HEMLOCK	200

8	31.METALDE	190
9	* 29.MENINGI	175
10	11.ERGOT	160

* * * 7.B.S.E Profile total 230 Ranked number 6

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank	Condition	Sum of PPFs
1	* * * 18.HYPOMAG	245
2	* * * 33.MILK FE	240
3	38.OXALATE	240
4	* 48.TETANUS	240
5	* * 24.LEAD AC	235
6	* * * 7.B.S.E	230
7	17.HEMLOCK	200
8	31.METALDE	190
9	* 29.MENINGI	175
10	11.ERGOT	160

* * * 7.B.S.E Profile total 230 Ranked number 6

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank	Condition	Sum of PPFs
1	14.FURIZOL	1260
2	47.STRYCHN	1255
3	* 27.LOUPING	1250
4	38.OXALATE	1250
5	* 21.LABERNU	1240
6	31.METALDE	1240
7	35.ORGANOP.	1240
8	* 29.MENINGI	1235
9	10.CYANIDE	1220
10	49.TOXOPLA	1220

* * * 7.B.S.E Profile total 827 Ranked number 52

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank	Condition	Sum of PPFs
1	47.STRYCHN	1255
2	* 27.LOUPING	1250
3	38.OXALATE	1250
4	31.METALDE	1240
5	* 29.MENINGI	1235
6	10.CYANIDE	1220
7	* 48.TETANUS	1210
8	13.FLUORIN	1205
9	* * * 33.MILK FE	1180
10	36.ORGANOC.	1170

* * * 7.B.S.E Profile total 827 Ranked number 19

28. LICE

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

10. LICKING\BITING
12. SICK 2 WEEKS OR MORE

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	28.LICE	190
2	* *	43.S.MANGE	190
3	* *	40.P.MANGE	145
4	*	41.P.P.H.	145
5	* * *	7.B.S.E	140
6		3.BRAIN A	95
7		8.B.V.L.	95
8	*	37.OTITIS	95
9		52.VIT A D	95
10		4.BRAIN T	70

* * * 7.B.S.E Profile total 140 Ranked number 5

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	28.LICE	190
2	* *	43.S.MANGE	190
3	* *	40.P.MANGE	145
4	*	41.P.P.H.	145
5	* * *	7.B.S.E	140
6		30.MERCURY	60

* * * 7.B.S.E Profile total 140 Ranked number 5

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank Condition Sum of PPFs

1	* *	43.S.MANGE	1390
2	* *	40.P.MANGE	1345
3	*	41.P.P.H.	1275
4	* * *	28.LICE	1250
5		39.PEN ALL	1250
6	*	32.MILK AL	1175
7		8.B.V.L.	1155
8	*	12.FAT C.S	1130
9	* *	34.OES.OBS	1130
10		52.VIT A D	1125

* * * 7.B.S.E Profile total 747 Ranked number 55

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1	* *	43.S.MANGE	1390
2	* *	40.P.MANGE	1345
3	*	41.P.P.H.	1275
4	* * *	28.LICE	1250
5		30.MERCURY	995
6	* * *	7.B.S.E	747

* * * 7.B.S.E Profile total 747 Ranked number 6

29. MENINGITIS

Condition prevalence

The conditions are classified according to their
relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

11. MUSCLE TREMORS
13. STAGGERING\DIFFICULTY WALKING

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* *	24.LEAD AC	165
2		17.HEMLOCK	160
3	* * *	33.MILK FE	160
4		38.OXALATE	160
5	* * *	7.B.S.E	150
6	* * *	18.HYPOMAG	150
7	*	2.BLACK L	145
8	*	16.HAEMOPH	145
9	*	29.MENINGI	145

10 * 48.TETANUS 145

* * * 7.B.S.E Profile total 150 Ranked number 5

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* *	24.LEAD AC	165
2		17.HEMLOCK	160
3	* * *	33.MILK FE	160
4		38.OXALATE	160
5	* * *	7.B.S.E	150
6	* * *	18.HYPOMAG	150
7	*	2.BLACK L	145
8	*	16.HAEMOPH	145
9	*	29.MENINGI	145
10	*	48.TETANUS	145

* * * 7.B.S.E Profile total 150 Ranked number 5

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1		35.ORGANOP.	1340
2	*	6.BOTULIS	1300
3	*	55.YEW	1300
4	*	46.SPINE I	1295
5		54.WATER I	1290
6		10.CYANIDE	1280
7	*	29.MENINGI	1275
8	*	2.BLACK L	1265
9	*	27.LOUPING	1250
10		31.METALDE	1240

* * * 7.B.S.E Profile total 767 Ranked number 55

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1		35.ORGANOP.	1340
2	*	6.BOTULIS	1300
3	*	55.YEW	1300
4		54.WATER I	1290
5		10.CYANIDE	1280
6	*	29.MENINGI	1275
7	*	2.BLACK L	1265
8	*	27.LOUPING	1250
9		31.METALDE	1240
10	*	51.UREA	1240

* * * 7.B.S.E Profile total 767 Ranked number 33

30. MERCURY

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

5. EXAGGERATED RESPONSES
13. STAGGERING\DIFFICULTY WALKING
14. WEIGHT LOSS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	*	48.TETANUS	260
2	* * *	7.B.S.E	240
3		30.MERCURY	215
4		38.OXALATE	210
5	* * *	18.HYPOMAG	175
6		4.BRAIN T	170
7	* *	9.CCN	165
8	* *	24.LEAD AC	165
9		14.FURIZOL	160
10	* * *	33.MILK FE	160

* * * 7.B.S.E Profile total 240 Ranked number 2

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	*	48.TETANUS	260
2	* * *	7.B.S.E	240
3		30.MERCURY	215
4		38.OXALATE	210
5		4.BRAIN T	170
6	* * *	19.KETOSIS	130
7	*	29.MENINGI	130
8		52.VIT A D	90
9	* *	23.LEAD CH	65

* * * 7.B.S.E Profile total 240 Ranked number 2

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1		14.FURIZOL	1260
2	*	48.TETANUS	1250
3	*	21.LABERNU	1240
4		49.TOXOPLA	1220
5		30.MERCURY	1205
6	* *	22.LAMINIT	1195
7	*	46.SPINE I	1195
8		47.STRYCHN	1195
9		38.OXALATE	1190
10		53.WATER D	1185

* * * 7.B.S.E Profile total 847 Ranked number 52

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1	*	48.TETANUS	1250
2		30.MERCURY	1205
3		38.OXALATE	1190
4	*	29.MENINGI	1145
5		4.BRAIN T	1015
6	* * *	19.KETOSIS	1015
7		52.VIT A D	1015
8	* *	23.LEAD CH	990
9	* * *	7.B.S.E	847

* * * 7.B.S.E Profile total 847 Ranked number 9

31. METALDEHYDE

Condition prevalence

The conditions are classified according to their
relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

3. BLINDNESS
5. EXAGGERATED RESPONSES
11. MUSCLE TREMORS
13. STAGGERING\DIFFICULTY WALKING

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* *	24.LEAD AC	330
2	* * *	18.HYPOMAG	245

```
3          31.METALDE   240
4   * * *  33.MILK FE   240
5          38.OXALATE   240
6       *  48.TETANUS   240
7   * * *   7.B.S.E     231
8          50.TR.TET    215
9       *  29.MENINGI   205
10         17.HEMLOCK   200
```

* * * 7.B.S.E Profile total 231 Ranked number 7

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

```
Rank       Condition    Sum of PPFs

1     * *  24.LEAD AC   330
2          31.METALDE   240
3   * * *   7.B.S.E     231
4       *  29.MENINGI   205
5          11.ERGOT     180
6           4.BRAIN T   175
7          30.MERCURY   170
8     * *  23.LEAD CH   135
```

* * * 7.B.S.E Profile total 231 Ranked number 3

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

```
Rank       Condition    Sum of PPFs

1     * *  24.LEAD AC   1245
2          31.METALDE   1240
3       *  29.MENINGI   1195
4          50.TR.TET    1165
5          14.FURIZOL   1160
6          47.STRYCHN   1155
7       *  27.LOUPING   1150
8          38.OXALATE   1150
9       *  21.LABERNU   1140
10         35.ORGANOP.  1140
```

* * * 7.B.S.E Profile total 729 Ranked number 53

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

```
Rank       Condition      Sum of PPFs

1     * *  24.LEAD AC   1245
2          31.METALDE   1240
3       *  29.MENINGI   1195
4          11.ERGOT     1100
5     * *  23.LEAD CH   1030
6          30.MERCURY   1015
7           4.BRAIN T   925
8   * * *   7.B.S.E     729
```

* * * 7.B.S.E Profile total 729 Ranked number 8

32. MILK ALLERGY

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

10. LICKING\BITING
11. MUSCLE TREMORS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	*	32.MILK AL	120
2	* * *	7.B.S.E	115
3	*	6.BOTULIS	95
4	*	16.HAEMOPH	95
5	* * *	28.LICE	95
6	*	41.P.P.H.	95
7	* *	43.S.MANGE	95
8	* * *	33.MILK FE	80
9		38.OXALATE	80
10	*	12.FAT C.S	70

* * * 7.B.S.E Profile total 115 Ranked number 2

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	*	32.MILK AL	120
2	* * *	7.B.S.E	115
3		30.MERCURY	50

* * * 7.B.S.E Profile total 115 Ranked number 2

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1	*	32.MILK AL	1275
2	*	6.BOTULIS	1260

3		39.PEN ALL	1250
4	*	12.FAT C.S	1210
5		35.ORGANOP.	1200
6	* *	43.S.MANGE	1200
7	*	55.YEW	1200
8		13.FLUORIN	1195
9		54.WATER I	1190
10		10.CYANIDE	1180

* * * 7.B.S.E Profile total 697 Ranked number 55

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1	*	32.MILK AL	1275
2		30.MERCURY	975
3	* * *	7.B.S.E	697

* * * 7.B.S.E Profile total 697 Ranked number 3

33. MILK FEVER

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

5. EXAGGERATED RESPONSES
6. FALLING
11. MUSCLE TREMORS
13. STAGGERING\DIFFICULTY WALKING

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	*	48.TETANUS	290
2	* * *	33.MILK FE	280
3		38.OXALATE	280
4	* * *	18.HYPOMAG	275
5	* * *	7.B.S.E	265
6	* *	24.LEAD AC	235
7		17.HEMLOCK	200
8		50.TR.TET	195
9		31.METALDE	190
10		4.BRAIN T	175

* * * 7.B.S.E Profile total 265 Ranked number 5

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	*	48.TETANUS	290
2	* * *	33.MILK FE	280
3		38.OXALATE	280
4	* * *	18.HYPOMAG	275
5	* * *	7.B.S.E	265
6		4.BRAIN T	175

* * * 7.B.S.E Profile total 265 Ranked number 5

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1		38.OXALATE	1230
2	*	48.TETANUS	1210
3		14.FURIZOL	1160
4	* * *	33.MILK FE	1160
5		47.STRYCHN	1155
6	*	27.LOUPING	1150
7	*	21.LABERNU	1140
8		31.METALDE	1140
9		35.ORGANOP.	1140
10	*	29.MENINGI	1135

* * * 7.B.S.E Profile total 797 Ranked number 51

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1		38.OXALATE	1230
2	*	48.TETANUS	1210
3	* * *	33.MILK FE	1160
4	* * *	18.HYPOMAG	1100
5		4.BRAIN T	925
6	* * *	7.B.S.E	797

* * * 7.B.S.E Profile total 797 Ranked number 6

35. ORGANOPHOSPHEROUS

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently

* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

11. MUSCLE TREMORS
13. STAGGERING\DIFFICULTY WALKING

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* *	24.LEAD AC	165
2		17.HEMLOCK	160
3	* * *	33.MILK FE	160
4		38.OXALATE	160
5	* * *	7.B.S.E	150
6	* * *	18.HYPOMAG	150
7	*	2.BLACK L	145
8	*	16.HAEMOPH	145
9	*	29.MENINGI	145
10	*	48.TETANUS	145

* * * 7.B.S.E Profile total 150 Ranked number 5

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* *	24.LEAD AC	165
2		17.HEMLOCK	160
3	* * *	33.MILK FE	160
4		38.OXALATE	160
5	* * *	7.B.S.E	150
6	* * *	18.HYPOMAG	150
7	*	2.BLACK L	145
8	*	16.HAEMOPH	145
9	*	29.MENINGI	145
10	*	48.TETANUS	145

* * * 7.B.S.E Profile total 150 Ranked number 5

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1		35.ORGANOP.	1340
2	*	6.BOTULIS	1300
3	*	55.YEW	1300
4	*	46.SPINE I	1295
5		54.WATER I	1290
6		10.CYANIDE	1280
7	*	29.MENINGI	1275
8	*	2.BLACK L	1265
9	*	27.LOUPING	1250

10 31.METALDE 1240

* * * 7.B.S.E Profile total 767 Ranked number 55

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1		35.ORGANOP.	1340
2	*	6.BOTULIS	1300
3	*	55.YEW	1300
4		54.WATER I	1290
5		10.CYANIDE	1280
6	*	29.MENINGI	1275
7	*	2.BLACK L	1265
8	*	27.LOUPING	1250
9		31.METALDE	1240
10	*	51.UREA	1240

* * * 7.B.S.E Profile total 767 Ranked number 33

36. ORGANOCHLORIDE

Condition prevalence

The conditions are classified according to their
relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

2. APPREHENSION\NERVOUS
5. EXAGGERATED RESPONSES
11. MUSCLE TREMORS
13. STAGGERING\DIFFICULTY WALKING

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	315
2	* * *	18.HYPOMAG	295
3	* * *	33.MILK FE	280
4		17.HEMLOCK	270
5		38.OXALATE	240
6	*	48.TETANUS	240
7	* *	24.LEAD AC	235
8		36.ORGANOC.	230
9		11.ERGOT	210
10		31.METALDE	190

* * * 7.B.S.E Profile total 315 Ranked number 1

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	315
2	* * *	18.HYPOMAG	295
3	* * *	33.MILK FE	280
4		17.HEMLOCK	270
5		36.ORGANOC.	230
6		11.ERGOT	210

* * * 7.B.S.E Profile total 315 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1		36.ORGANOC.	1210
2		17.HEMLOCK	1200
3		11.ERGOT	1160
4		14.FURIZOL	1160
5	* * *	33.MILK FE	1160
6		47.STRYCHN	1155
7	*	27.LOUPING	1150
8		38.OXALATE	1150
9	* * *	18.HYPOMAG	1140
10	*	21.LABERNU	1140

* * * 7.B.S.E Profile total 897 Ranked number 40

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1		36.ORGANOC.	1210
2		17.HEMLOCK	1200
3		11.ERGOT	1160
4	* * *	33.MILK FE	1160
5	* * *	18.HYPOMAG	1140
6	* * *	7.B.S.E	897

* * * 7.B.S.E Profile total 897 Ranked number 6

37. OTITIS

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently

* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

1. ABNORMAL HEAD\EAR POSITION
4. CIRCLING
12. SICK 2 WEEKS OR MORE

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank	Condition	Sum of PPFs
1	* 37.OTITIS	290
2	15.GID	175
3	* * * 28.LICE	175
4	* * * 7.B.S.E	161
5	4.BRAIN T	120
6	1.ARSENIC	110
7	3.BRAIN A	100
8	8.B.V.L.	95
9	* * 26.LISTERI	95
10	* * 40.P.MANGE	95

* * * 7.B.S.E Profile total 161 Ranked number 4

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank	Condition	Sum of PPFs
1	* 37.OTITIS	290
2	15.GID	175
3	* * * 7.B.S.E	161
4	* * 26.LISTERI	95

* * * 7.B.S.E Profile total 161 Ranked number 3

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank	Condition	Sum of PPFs
1	* 37.OTITIS	1330
2	* * 40.P.MANGE	1145
3	* * * 28.LICE	1120
4	* * 43.S.MANGE	1100
5	* * 34.OES.OBS	1070
6	* 51.UREA	1060
7	8.B.V.L.	1055
8	39.PEN ALL	1050
9	* 2.BLACK L	1035
10	* 12.FAT C.S	1030

* * * 7.B.S.E Profile total 689 Ranked number 54

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1	*	37.OTITIS	1330
2		15.GID	975
3	* *	26.LISTERI	940
4	* * *	7.B.S.E	689

* * * 7.B.S.E Profile total 689 Ranked number 4

38. OXALATE

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

5. EXAGGERATED RESPONSES
11. MUSCLE TREMORS
13. STAGGERING\DIFFICULTY WALKING
14. WEIGHT LOSS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	310
2	*	48.TETANUS	310
3		38.OXALATE	290
4	* * *	18.HYPOMAG	245
5	* * *	33.MILK FE	240
6	* *	24.LEAD AC	235
7		30.MERCURY	235
8		17.HEMLOCK	200
9		31.METALDE	190
10	*	29.MENINGI	180

* * * 7.B.S.E Profile total 310 Ranked number 1

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	310
2	*	48.TETANUS	310
3		38.OXALATE	290

4		30.MERCURY	235
5	*	29.MENINGI	180
6		4.BRAIN T	175
7	* *	23.LEAD CH	70

* * * 7.B.S.E Profile total 310 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1		38.OXALATE	1250
2	*	48.TETANUS	1250
3		14.FURIZOL	1160
4		44.SALT	1160
5		47.STRYCHN	1155
6	*	27.LOUPING	1150
7	*	29.MENINGI	1145
8		30.MERCURY	1145
9	*	21.LABERNU	1140
10		31.METALDE	1140

* * * 7.B.S.E Profile total 887 Ranked number 48

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1		38.OXALATE	1250
2	*	48.TETANUS	1250
3	*	29.MENINGI	1145
4		30.MERCURY	1145
5		4.BRAIN T	925
6	* *	23.LEAD CH	900
7	* * *	7.B.S.E	887

* * * 7.B.S.E Profile total 887 Ranked number 7

39. PENICILLIN ALLERGY

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

10. LICKING\BITING

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	28.LICE	95
2	*	41.P.P.H.	95
3	* *	43.S.MANGE	95
4	* * *	19.KETOSIS	70
5	*	32.MILK AL	70
6		25.LEVAMIZ	60
7		39.PEN ALL	50
8	* *	40.P.MANGE	50
9	* * *	7.B.S.E	45
10		30.MERCURY	30

* * * 7.B.S.E Profile total 45 Ranked number 9

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	28.LICE	95
2	*	41.P.P.H.	95
3	* *	43.S.MANGE	95
4	* * *	19.KETOSIS	70
5	*	32.MILK AL	70
6		25.LEVAMIZ	60
7		39.PEN ALL	50
8	* *	40.P.MANGE	50
9	* * *	7.B.S.E	45
10		30.MERCURY	30

* * * 7.B.S.E Profile total 45 Ranked number 9

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1		39.PEN ALL	1350
2	* *	43.S.MANGE	1300
3	*	32.MILK AL	1275
4	*	41.P.P.H.	1275
5	* *	40.P.MANGE	1255
6	* *	34.OES.OBS	1230
7	*	46.SPINE I	1205
8	*	55.YEW	1200
9		13.FLUORIN	1195
10		54.WATER I	1190

* * * 7.B.S.E Profile total 657 Ranked number 55

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank Condition Sum of PPFs

1		39.PEN ALL	1350
2	* *	43.S.MANGE	1300
3	*	32.MILK AL	1275
4	*	41.P.P.H.	1275
5	* *	40.P.MANGE	1255
6		25.LEVAMIZ	1160
7	* * *	28.LICE	1160
8	* * *	19.KETOSIS	1095
9		30.MERCURY	1035
10	* * *	7.B.S.E	657

* * * 7.B.S.E   Profile total 657 Ranked number 10

40. PSOROPTIC MANGE

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

10. LICKING\BITING
12. SICK 2 WEEKS OR MORE

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	28.LICE	190
2	* *	43.S.MANGE	190
3	* *	40.P.MANGE	145
4	*	41.P.P.H.	145
5	* * *	7.B.S.E	140
6		3.BRAIN A	95
7		8.B.V.L.	95
8	*	37.OTITIS	95
9		52.VIT A D	95
10		4.BRAIN T	70

* * * 7.B.S.E   Profile total 140 Ranked number 5

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	28.LICE	190
2	* *	43.S.MANGE	190
3	* *	40.P.MANGE	145
4	*	41.P.P.H.	145

5	* * *	7.B.S.E	140
6		30.MERCURY	60

* * * 7.B.S.E Profile total 140 Ranked number 5

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1	* *	43.S.MANGE	1390
2	* *	40.P.MANGE	1345
3	*	41.P.P.H.	1275
4	* * *	28.LICE	1250
5		39.PEN ALL	1250
6	*	32.MILK AL	1175
7		8.B.V.L.	1155
8	*	12.FAT C.S	1130
9	* *	34.OES.OBS	1130
10		52.VIT A D	1125

* * * 7.B.S.E Profile total 747 Ranked number 55

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1	* *	43.S.MANGE	1390
2	* *	40.P.MANGE	1345
3	*	41.P.P.H.	1275
4	* * *	28.LICE	1250
5		30.MERCURY	995
6	* * *	7.B.S.E	747

* * * 7.B.S.E Profile total 747 Ranked number 6

41. PRURITIS PYREXIA AND HAEMORRHAGE

Condition prevalence

The conditions are classified according to their
relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

10. LICKING\BITING
12. SICK 2 WEEKS OR MORE
14. WEIGHT LOSS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	220
2	*	41.P.P.H.	215
3	* * *	28.LICE	190
4	* *	43.S.MANGE	190
5		8.B.V.L.	165
6		30.MERCURY	155
7		1.ARSENIC	145
8	* *	40.P.MANGE	145
9	* * *	20.KETOSIS	125
10	*	37.OTITIS	125

* * * 7.B.S.E Profile total 220 Ranked number 1

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	220
2	*	41.P.P.H.	215
3		30.MERCURY	155

* * * 7.B.S.E Profile total 220 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1	*	41.P.P.H.	1315
2	* *	43.S.MANGE	1290
3	* *	40.P.MANGE	1245
4		8.B.V.L.	1195
5	* * *	20.KETOSIS	1195
6	* * *	28.LICE	1150
7		39.PEN ALL	1150
8		1.ARSENIC	1095
9	*	12.FAT C.S	1090
10		30.MERCURY	1085

* * * 7.B.S.E Profile total 807 Ranked number 50

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1	*	41.P.P.H.	1315
2		30.MERCURY	1085
3	* * *	7.B.S.E	807

* * * 7.B.S.E Profile total 807 Ranked number 3

42. RAGWORT

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

14. WEIGHT LOSS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1		1.ARSENIC	95
2	* * *	20.KETOSIS	95
3		30.MERCURY	95
4	* * *	7.B.S.E	80
5		8.B.V.L.	70
6	* *	9.CCN	70
7	*	41.P.P.H.	70
8	*	42.RAGWORT	70
9		44.SALT	70
10	*	48.TETANUS	70

* * * 7.B.S.E Profile total 80 Ranked number 4

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1		1.ARSENIC	95
2	* * *	20.KETOSIS	95
3		30.MERCURY	95
4	* * *	7.B.S.E	80
5		8.B.V.L.	70
6	* *	9.CCN	70
7	*	41.P.P.H.	70
8	*	42.RAGWORT	70
9		44.SALT	70
10	*	48.TETANUS	70

* * * 7.B.S.E Profile total 80 Ranked number 4

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank Condition Sum of PPFs

1	* * *	20.KETOSIS	1335
2	*	42.RAGWORT	1280
3		44.SALT	1260
4		39.PEN ALL	1250
5		53.WATER D	1245
6	*	12.FAT C.S	1230
7	* *	34.OES.OBS	1230
8	*	41.P.P.H.	1225
9		45.SELENIU	1210
10		8.B.V.L.	1205

* * * 7.B.S.E Profile total 727 Ranked number 55

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	20.KETOSIS	1335
2	*	42.RAGWORT	1280
3		44.SALT	1260
4		53.WATER D	1245
5	*	12.FAT C.S	1230
6	*	41.P.P.H.	1225
7		45.SELENIU	1210
8		8.B.V.L.	1205
9	* *	22.LAMINIT	1205
10		1.ARSENIC	1195

* * * 7.B.S.E Profile total 727 Ranked number 25

43. SARCOPTIC MANGE

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

10. LICKING\BITING
12. SICK 2 WEEKS OR MORE

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	28.LICE	190
2	* *	43.S.MANGE	190
3	* *	40.P.MANGE	145
4	*	41.P.P.H.	145

5	* * *	7.B.S.E	140
6		3.BRAIN A	95
7		8.B.V.L.	95
8	*	37.OTITIS	95
9		52.VIT A D	95
10		4.BRAIN T	70

* * * 7.B.S.E Profile total 140 Ranked number 5

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	28.LICE	190
2	* *	43.S.MANGE	190
3	* *	40.P.MANGE	145
4	*	41.P.P.H.	145
5	* * *	7.B.S.E	140
6		30.MERCURY	60

* * * 7.B.S.E Profile total 140 Ranked number 5

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1	* *	43.S.MANGE	1390
2	* *	40.P.MANGE	1345
3	*	41.P.P.H.	1275
4	* * *	28.LICE	1250
5		39.PEN ALL	1250
6	*	32.MILK AL	1175
7		8.B.V.L.	1155
8	*	12.FAT C.S	1130
9	* *	34.OES.OBS	1130
10		52.VIT A D	1125

* * * 7.B.S.E Profile total 747 Ranked number 55

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1	* *	43.S.MANGE	1390
2	* *	40.P.MANGE	1345
3	*	41.P.P.H.	1275
4	* * *	28.LICE	1250
5		30.MERCURY	995
6	* * *	7.B.S.E	747

* * * 7.B.S.E Profile total 747 Ranked number 6

44. SALT POISONING

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

3. BLINDNESS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1		3.BRAIN A	95
2	* *	9.CCN	95
3	* *	23.LEAD CH	95
4	* *	24.LEAD AC	95
5		50.TR.TET	70
6		52.VIT A D	70
7		15.GID	50
8	*	16.HAEMOPH	50
9	* *	26.LISTERI	50
10		31.METALDE	50

* * * 7.B.S.E Profile total 1 Ranked number 20

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1		3.BRAIN A	95
2	* *	9.CCN	95
3	* *	23.LEAD CH	95
4	* *	24.LEAD AC	95
5		50.TR.TET	70
6		52.VIT A D	70
7		15.GID	50
8	*	16.HAEMOPH	50
9	* *	26.LISTERI	50
10		31.METALDE	50

* * * 7.B.S.E Profile total 1 Ranked number 20

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1	* *	23.LEAD CH	1250
2		39.PEN ALL	1250

3	* *	34.OES.OBS	1230
4		45.SELENIU	1210
5	*	46.SPINE I	1205
6	*	55.YEW	1200
7		13.FLUORIN	1195
8	*	6.BOTULIS	1190
9		54.WATER I	1190
10		10.CYANIDE	1180

* * * 7.B.S.E Profile total 569 Ranked number 55

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1	* *	23.LEAD CH	1250
2		45.SELENIU	1210
3	*	6.BOTULIS	1190
4	*	42.RAGWORT	1180
5		50.TR.TET	1175
6		52.VIT A D	1175
7		31.METALDE	1160
8	*	16.HAEMOPH	1145
9	*	29.MENINGI	1145
10	* *	9.CCN	1120

* * * 7.B.S.E Profile total 569 Ranked number 20

45. SELENIUM

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

3. BLINDNESS
13. STAGGERING\DIFFICULTY WALKING
14. WEIGHT LOSS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* *	9.CCN	260
2		30.MERCURY	195
3	* *	24.LEAD AC	190
4		1.ARSENIC	165
5	*	48.TETANUS	165
6	* * *	7.B.S.E	161

7	* *	23.LEAD CH	155
8		45.SELENIU	150
9		52.VIT A D	150
10		3.BRAIN A	145

* * * 7.B.S.E Profile total 161 Ranked number 6

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* *	9.CCN	260
2		30.MERCURY	195
3		1.ARSENIC	165
4	* * *	7.B.S.E	161
5	* *	23.LEAD CH	155
6		45.SELENIU	150
7		52.VIT A D	150
8		15.GID	140
9		4.BRAIN T	130
10	*	16.HAEMOPH	130

* * * 7.B.S.E Profile total 161 Ranked number 4

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1	* *	9.CCN	1250
2		45.SELENIU	1210
3	* *	22.LAMINIT	1195
4	*	46.SPINE I	1195
5		53.WATER D	1185
6	*	42.RAGWORT	1180
7	* *	23.LEAD CH	1170
8		30.MERCURY	1165
9		44.SALT	1160
10		8.B.V.L.	1145

* * * 7.B.S.E Profile total 689 Ranked number 55

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1	* *	9.CCN	1250
2		45.SELENIU	1210
3	*	42.RAGWORT	1180
4	* *	23.LEAD CH	1170
5		30.MERCURY	1165
6	*	29.MENINGI	1145
7		1.ARSENIC	1135
8		52.VIT A D	1135
9	*	16.HAEMOPH	1105
10	* *	26.LISTERI	1010

* * * 7.B.S.E   Profile total 689   Ranked number 14

46. SPINAL INJURY

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

13. STAGGERING\DIFFICULTY WALKING

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank	Condition	Sum of PPFs
1	* 2.BLACK L	95
2	* * 9.CCN	95
3	* * 22.LAMINIT	95
4	* * 24.LEAD AC	95
5	* 29.MENINGI	95
6	* 46.SPINE I	95
7	* 48.TETANUS	95
8	17.HEMLOCK	90
9	* * * 7.B.S.E	80
10	15.GID	80

* * * 7.B.S.E   Profile total 80   Ranked number 9

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank	Condition	Sum of PPFs
1	* 2.BLACK L	95
2	* * 9.CCN	95
3	* * 22.LAMINIT	95
4	* * 24.LEAD AC	95
5	* 29.MENINGI	95
6	* 46.SPINE I	95
7	* 48.TETANUS	95
8	17.HEMLOCK	90
9	* * * 7.B.S.E	80
10	15.GID	80

* * * 7.B.S.E   Profile total 80   Ranked number 9

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1	*	46.SPINE I	1395
2	* *	22.LAMINIT	1335
3		49.TOXOPLA	1320
4	*	21.LABERNU	1300
5		35.ORGANOP.	1300
6	*	55.YEW	1300
7		54.WATER I	1290
8		10.CYANIDE	1280
9		14.FURIZOL	1280
10	*	29.MENINGI	1275

* * * 7.B.S.E Profile total 727 Ranked number 55

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1	*	46.SPINE I	1395
2	* *	22.LAMINIT	1335
3		49.TOXOPLA	1320
4	*	21.LABERNU	1300
5		35.ORGANOP.	1300
6	*	55.YEW	1300
7		54.WATER I	1290
8		10.CYANIDE	1280
9		14.FURIZOL	1280
10	*	29.MENINGI	1275

* * * 7.B.S.E Profile total 727 Ranked number 46

47. STRYCHNINE

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

5. EXAGGERATED RESPONSES

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	18.HYPOMAG	95
2		47.STRYCHN	95

3	* 48.TETANUS	95
4	50.TR.TET	95
5	14.FURIZOL	90
6	* * * 7.B.S.E	80
7	25.LEVAMIZ	80
8	* * * 33.MILK FE	80
9	38.OXALATE	80
10	4.BRAIN T	70

* * * 7.B.S.E Profile total 80 Ranked number 6

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank	Condition	Sum of PPFs
1	* * * 18.HYPOMAG	95
2	47.STRYCHN	95
3	* 48.TETANUS	95
4	50.TR.TET	95
5	14.FURIZOL	90
6	* * * 7.B.S.E	80
7	25.LEVAMIZ	80
8	* * * 33.MILK FE	80
9	38.OXALATE	80
10	4.BRAIN T	70

* * * 7.B.S.E Profile total 80 Ranked number 6

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank	Condition	Sum of PPFs
1	47.STRYCHN	1335
2	14.FURIZOL	1320
3	* 21.LABERNU	1300
4	13.FLUORIN	1295
5	49.TOXOPLA	1280
6	* 27.LOUPING	1250
7	39.PEN ALL	1250
8	* * 34.OES.OBS	1230
9	50.TR.TET	1225
10	10.CYANIDE	1220

* * * 7.B.S.E Profile total 727 Ranked number 55

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank	Condition	Sum of PPFs
1	47.STRYCHN	1335
2	14.FURIZOL	1320
3	* 21.LABERNU	1300
4	13.FLUORIN	1295
5	49.TOXOPLA	1280
6	* 27.LOUPING	1250

7	50.TR.TET	1225
8	10.CYANIDE	1220
9	25.LEVAMIZ	1200
10	31.METALDE	1160

* * * 7.B.S.E Profile total 727 Ranked number 26

48. TETANUS

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

5. EXAGGERATED RESPONSES
6. FALLING
11. MUSCLE TREMORS
13. STAGGERING\DIFFICULTY WALKING
14. WEIGHT LOSS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	*	48.TETANUS	360
2	* * *	7.B.S.E	345
3		38.OXALATE	330
4	* * *	33.MILK FE	280
5	* * *	18.HYPOMAG	275
6	* *	24.LEAD AC	235
7		30.MERCURY	235
8		4.BRAIN T	205
9	*	16.HAEMOPH	205
10	*	5.B.M.C.	200

* * * 7.B.S.E Profile total 345 Ranked number 2

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	*	48.TETANUS	360
2	* * *	7.B.S.E	345
3		38.OXALATE	330
4		4.BRAIN T	205

* * * 7.B.S.E Profile total 345 Ranked number 2

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank	Condition	Sum of PPFs
1	* 48.TETANUS	1250
2	38.OXALATE	1230
3	44.SALT	1080
4	14.FURIZOL	1060
5	* * * 33.MILK FE	1060
6	* 16.HAEMOPH	1055
7	47.STRYCHN	1055
8	* 27.LOUPING	1050
9	* 5.B.M.C.	1045
10	* 29.MENINGI	1045

* * * 7.B.S.E Profile total 857 Ranked number 41

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank	Condition	Sum of PPFs
1	* 48.TETANUS	1250
2	38.OXALATE	1230
3	4.BRAIN T	885
4	* * * 7.B.S.E	857

* * * 7.B.S.E Profile total 857 Ranked number 4

49. TOXOPLASMOSIS

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

5. EXAGGERATED RESPONSES
13. STAGGERING\DIFFICULTY WALKING

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank	Condition	Sum of PPFs
1	* 48.TETANUS	190
2	* * * 18.HYPOMAG	175
3	* * 24.LEAD AC	165
4	* * * 7.B.S.E	160
5	14.FURIZOL	160

```
6   * * * 33.MILK FE    160
7         38.OXALATE    160
8         50.TR.TET     145
9          4.BRAIN T    140
10      * 21.LABERNU    140

* * *   7.B.S.E       Profile total 160  Ranked number 4
```

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

```
Rank      Condition    Sum of PPFs

1       * 48.TETANUS    190
2   * * * 18.HYPOMAG    175
3     * * 24.LEAD AC    165
4   * * *  7.B.S.E      160
5         14.FURIZOL    160
6   * * * 33.MILK FE    160
7         38.OXALATE    160
8         50.TR.TET     145
9          4.BRAIN T    140
10      * 21.LABERNU    140

* * *   7.B.S.E       Profile total 160  Ranked number 4
```

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

```
Rank      Condition    Sum of PPFs

1         14.FURIZOL    1360
2       * 21.LABERNU    1340
3         49.TOXOPLA    1320
4       * 46.SPINE I    1295
5         47.STRYCHN    1295
6       * 27.LOUPING    1250
7     * * 22.LAMINIT    1235
8       * 29.MENINGI    1235
9         50.TR.TET     1225
10        10.CYANIDE    1220

* * *   7.B.S.E       Profile total 787  Ranked number 55
```

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

```
Rank      Condition      Sum of PPFs

1         14.FURIZOL    1360
2       * 21.LABERNU    1340
3         49.TOXOPLA    1320
4         47.STRYCHN    1295
5       * 27.LOUPING    1250
6       * 29.MENINGI    1235
7         50.TR.TET     1225
8         10.CYANIDE    1220
9       * 48.TETANUS    1210
```

10 13.FLUORIN 1205

* * * 7.B.S.E Profile total 787 Ranked number 25

50. TRANSIT TETANY

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

5. EXAGGERATED RESPONSES
6. FALLING
13. STAGGERING\DIFFICULTY WALKING

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	*	48.TETANUS	240
2	* * *	18.HYPOMAG	205
3	* * *	33.MILK FE	200
4		38.OXALATE	200
5	* * *	7.B.S.E	195
6		50.TR.TET	195
7		4.BRAIN T	170
8	* *	24.LEAD AC	165
9		14.FURIZOL	160
10		15.GID	150

* * * 7.B.S.E Profile total 195 Ranked number 5

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	*	48.TETANUS	240
2	* * *	18.HYPOMAG	205
3	* * *	33.MILK FE	200
4		38.OXALATE	200
5	* * *	7.B.S.E	195
6		50.TR.TET	195
7		4.BRAIN T	170
8	* * *	19.KETOSIS	115
9		52.VIT A D	65

* * * 7.B.S.E Profile total 195 Ranked number 5

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1		14.FURIZOL	1260
2	*	21.LABERNU	1240
3		50.TR.TET	1225
4		49.TOXOPLA	1220
5	*	48.TETANUS	1210
6	*	46.SPINE I	1195
7		47.STRYCHN	1195
8		38.OXALATE	1170
9	*	27.LOUPING	1150
10	* *	22.LAMINIT	1135

* * * 7.B.S.E Profile total 757 Ranked number 55

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1		50.TR.TET	1225
2	*	48.TETANUS	1210
3		38.OXALATE	1170
4	* * *	33.MILK FE	1100
5	* * *	18.HYPOMAG	1060
6		4.BRAIN T	1015
7	* * *	19.KETOSIS	985
8		52.VIT A D	965
9	* * *	7.B.S.E	757

* * * 7.B.S.E Profile total 757 Ranked number 9

51. UREA

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

11. MUSCLE TREMORS
13. STAGGERING\DIFFICULTY WALKING

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank Condition Sum of PPFs

```
1      * * 24.LEAD AC    165
2          17.HEMLOCK    160
3    * * * 33.MILK FE    160
4          38.OXALATE    160
5    * * *  7.B.S.E      150
6    * * * 18.HYPOMAG    150
7        *  2.BLACK L    145
8        * 16.HAEMOPH    145
9        * 29.MENINGI    145
10       * 48.TETANUS    145

* * *  7.B.S.E       Profile total 150  Ranked number 5
```

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

```
Rank       Condition    Sum of PPFs

1      * * 24.LEAD AC    165
2          17.HEMLOCK    160
3    * * * 33.MILK FE    160
4          38.OXALATE    160
5    * * *  7.B.S.E      150
6    * * * 18.HYPOMAG    150
7        *  2.BLACK L    145
8        * 16.HAEMOPH    145
9        * 29.MENINGI    145
10       * 48.TETANUS    145

* * *  7.B.S.E       Profile total 150  Ranked number 5
```

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

```
Rank       Condition    Sum of PPFs

1          35.ORGANOP.  1340
2        *  6.BOTULIS   1300
3        * 55.YEW       1300
4        * 46.SPINE I   1295
5          54.WATER I   1290
6          10.ÇYANIDE   1280
7        * 29.MENINGI   1275
8        *  2.BLACK L   1265
9        * 27.LOUPING   1250
10         31.METALDE   1240

* * *  7.B.S.E       Profile total 767  Ranked number 55
```

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

```
Rank       Condition      Sum of PPFs

1          35.ORGANOP.  1340
2        *  6.BOTULIS   1300
3        * 55.YEW       1300
4          54.WATER I   1290
```

5		10.CYANIDE	1280
6	*	29.MENINGI	1275
7	*	2.BLACK L	1265
8	*	27.LOUPING	1250
9		31.METALDE	1240
10	*	51.UREA	1240

* * * 7.B.S.E Profile total 767 Ranked number 33

52. VITAMIN A OR D TOXICITY

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

3. BLINDNESS
12. SICK 2 WEEKS OR MORE
13. STAGGERING\DIFFICULTY WALKING

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1		3.BRAIN A	240
2		52.VIT A D	215
3		15.GID	200
4	* *	9.CCN	195
5	* *	24.LEAD AC	190
6	* * *	7.B.S.E	176
7		4.BRAIN T	170
8		8.B.V.L.	165
9	*	29.MENINGI	130
10		30.MERCURY	130

* * * 7.B.S.E Profile total 176 Ranked number 6

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1		3.BRAIN A	240
2		52.VIT A D	215
3		15.GID	200
4	* *	9.CCN	195
5	* * *	7.B.S.E	176
6		4.BRAIN T	170
7	*	29.MENINGI	130
8		30.MERCURY	130

9		1.ARSENIC	120
10	* *	26.LISTERI	105

* * * 7.B.S.E Profile total 176 Ranked number 5

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1		52.VIT A D	1265
2		3.BRAIN A	1200
3		8.B.V.L.	1195
4	* *	22.LAMINIT	1195
5	*	46.SPINE I	1195
6	*	29.MENINGI	1145
7	* *	40.P.MANGE	1145
8	* *	9.CCN	1120
9		49.TOXOPLA	1120
10	* *	23.LEAD CH	1110

* * * 7.B.S.E Profile total 719 Ranked number 55

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1		52.VIT A D	1265
2		3.BRAIN A	1200
3	*	29.MENINGI	1145
4	* *	9.CCN	1120
5		1.ARSENIC	1045
6	*	6.BOTULIS	1040
7		30.MERCURY	1035
8		15.GID	1025
9		4.BRAIN T	1015
10	* *	26.LISTERI	960

* * * 7.B.S.E Profile total 719 Ranked number 11

53. WATER DEPRIVATION

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

7. FRENZY
13. STAGGERING\DIFFICULTY WALKING
14. WEIGHT LOSS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	190
2		53.WATER D	190
3	* *	9.CCN	170
4		30.MERCURY	165
5	*	48.TETANUS	165
6		1.ARSENIC	145
7	* *	24.LEAD AC	145
8		8.B.V.L.	140
9		38.OXALATE	130
10	* *	22.LAMINIT	125

* * * 7.B.S.E Profile total 190 Ranked number 1

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	190
2		53.WATER D	190
3	* *	9.CCN	170
4	*	5.B.M.C.	120
5	*	42.RAGWORT	120

* * * 7.B.S.E Profile total 190 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1		53.WATER D	1285
2	* *	22.LAMINIT	1195
3	*	46.SPINE I	1195
4	*	42.RAGWORT	1180
5		44.SALT	1160
6		8.B.V.L.	1145
7	* * *	20.KETOSIS	1135
8	* *	34.OES.OBS	1130
9		49.TOXOPLA	1120
10		45.SELENIU	1110

* * * 7.B.S.E Profile total 747 Ranked number 55

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank	Condition	Sum of PPFs
1	53.WATER D	1285

2	*	42.RAGWORT	1180
3	*	5.B.M.C.	1085
4	* *	9.CCN	1070
5	* * *	7.B.S.E	747

* * * 7.B.S.E Profile total 747 Ranked number 5

54. WATER INTOXICATION

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

11. MUSCLE TREMORS
13. STAGGERING\DIFFICULTY WALKING

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* *	24.LEAD AC	165
2		17.HEMLOCK	160
3	* * *	33.MILK FE	160
4		38.OXALATE	160
5	* * *	7.B.S.E	150
6	* * *	18.HYPOMAG	150
7	*	2.BLACK L	145
8	*	16.HAEMOPH	145
9	*	29.MENINGI	145
10	*	48.TETANUS	145

* * * 7.B.S.E Profile total 150 Ranked number 5

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* *	24.LEAD AC	165
2		17.HEMLOCK	160
3	* * *	33.MILK FE	160
4		38.OXALATE	160
5	* * *	7.B.S.E	150
6	* * *	18.HYPOMAG	150
7	*	2.BLACK L	145
8	*	16.HAEMOPH	145
9	*	29.MENINGI	145
10	*	48.TETANUS	145

* * * 7.B.S.E Profile total 150 Ranked number 5

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank	Condition	Sum of PPFs
1	35.ORGANOP.	1340
2	* 6.BOTULIS	1300
3	* 55.YEW	1300
4	* 46.SPINE I	1295
5	54.WATER I	1290
6	10.CYANIDE	1280
7	* 29.MENINGI	1275
8	* 2.BLACK L	1265
9	* 27.LOUPING	1250
10	31.METALDE	1240

* * * 7.B.S.E Profile total 767 Ranked number 55

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank	Condition	Sum of PPFs
1	35.ORGANOP.	1340
2	* 6.BOTULIS	1300
3	* 55.YEW	1300
4	54.WATER I	1290
5	10.CYANIDE	1280
6	* 29.MENINGI	1275
7	* 2.BLACK L	1265
8	* 27.LOUPING	1250
9	31.METALDE	1240
10	* 51.UREA	1240

* * * 7.B.S.E Profile total 767 Ranked number 33

55. YEW

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

11. MUSCLE TREMORS
13. STAGGERING\DIFFICULTY WALKING

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* *	24.LEAD AC	165
2		17.HEMLOCK	160
3	* * *	33.MILK FE	160
4		38.OXALATE	160
5	* * *	7.B.S.E	150
6	* * *	18.HYPOMAG	150
7	*	2.BLACK L	145
8	*	16.HAEMOPH	145
9	*	29.MENINGI	145
10	*	48.TETANUS	145

* * * 7.B.S.E Profile total 150 Ranked number 5

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* *	24.LEAD AC	165
2		17.HEMLOCK	160
3	* * *	33.MILK FE	160
4		38.OXALATE	160
5	* * *	7.B.S.E	150
6	* * *	18.HYPOMAG	150
7	*	2.BLACK L	145
8	*	16.HAEMOPH	145
9	*	29.MENINGI	145
10	*	48.TETANUS	145

* * * 7.B.S.E Profile total 150 Ranked number 5

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1		35.ORGANOP.	1340
2	*	6.BOTULIS	1300
3	*	55.YEW	1300
4	*	46.SPINE I	1295
5		54.WATER I	1290
6		10.CYANIDE	1280
7	*	29.MENINGI	1275
8	*	2.BLACK L	1265
9	*	27.LOUPING	1250
10		31.METALDE	1240

* * * 7.B.S.E Profile total 767 Ranked number 55

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank Condition Sum of PPFs

1		35.ORGANOP.	1340
2	*	6.BOTULIS	1300
3	*	55.YEW	1300
4		54.WATER I	1290
5		10.CYANIDE	1280
6	*	29.MENINGI	1275
7	*	2.BLACK L	1265
8	*	27.LOUPING	1250
9		31.METALDE	1240
10	*	51.UREA	1240

* * * 7.B.S.E Profile total 767 Ranked number 33

APPENDIX 6

B.S.E confirmed case reports: Analysis by pattern matching models 1,2,3, and 4.

B.S.E POSITIVE: Case number 1

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

12. SICK 2 WEEKS OR MORE
2. APPREHENSION\NERVOUS
5. EXAGGERATED RESPONSES
10. LICKING\BITING
7. FRENZY
9. KICKING IN PARLOUR
13. STAGGERING\DIFFICULTY WALKING
6. FALLING

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	500
2	* * *	18.HYPOMAG	310
3	* * *	33.MILK FE	270
4	* * *	28.LICE	250
5	*	48.TETANUS	250
6		3.BRAIN A	245
7	* *	24.LEAD AC	245
8		4.BRAIN T	240
9		15.GID	220
10	* * *	19.KETOSIS	215

* * * 7.B.S.E Profile total 500 Ranked number 1

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	500

* * * 7.B.S.E Profile total 500 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	867
2	* *	43.S.MANGE	790

3	* * *	18.HYPOMAG	770
4	* * *	28.LICE	770
5		14.FURIZOL	760
6		36.ORGANOC.	750
7	* *	40.P.MANGE	745
8	*	21.LABERNU	740
9	* * *	33.MILK FE	740
10	*	48.TETANUS	730

* * * 7.B.S.E Profile total 867 Ranked number 1

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	867

* * * 7.B.S.E Profile total 867 Ranked number 1

B.S.E POSITIVE: Case number 2

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

12. SICK 2 WEEKS OR MORE
2. APPREHENSION\NERVOUS
5. EXAGGERATED RESPONSES
1. ABNORMAL HEAD\EAR POSITION
13. STAGGERING\DIFFICULTY WALKING
6. FALLING
11. MUSCLE TREMORS
14. WEIGHT LOSS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	590
2	* * *	18.HYPOMAG	395
3	* * *	33.MILK FE	370
4	*	48.TETANUS	370
5		17.HEMLOCK	340
6		38.OXALATE	330
7		1.ARSENIC	275
8		4.BRAIN T	275
9		30.MERCURY	265
10		15.GID	260

* * * 7.B.S.E Profile total 590 Ranked number 1

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank	Condition	Sum of PPFs
1	* * * 7.B.S.E	590

* * * 7.B.S.E Profile total 590 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank	Condition	Sum of PPFs
1	* * * 7.B.S.E	1047
2	* 48.TETANUS	970
3	17.HEMLOCK	940
4	* * * 18.HYPOMAG	940
5	* * * 33.MILK FE	940
6	38.OXALATE	930
7	1.ARSENIC	855
8	8.B.V.L.	835
9	* 2.BLACK L	825
10	36.ORGANOC.	810

* * * 7.B.S.E Profile total 1047 Ranked number 1

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank	Condition	Sum of PPFs
1	* * * 7.B.S.E	1047

* * * 7.B.S.E Profile total 1047 Ranked number 1

B.S.E POSITIVE: Case number 3

Condition prevalence

The conditions are classified according to their
relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

12. SICK 2 WEEKS OR MORE
2. APPREHENSION\NERVOUS
5. EXAGGERATED RESPONSES
10. LICKING\BITING
13. STAGGERING\DIFFICULTY WALKING

11. MUSCLE TREMORS
14. WEIGHT LOSS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	535
2	*	48.TETANUS	320
3	* * *	18.HYPOMAG	295
4		30.MERCURY	295
5		38.OXALATE	290
6	* * *	33.MILK FE	280
7		17.HEMLOCK	270
8	* * *	28.LICE	250
9		4.BRAIN T	245
10		8.B.V.L.	235

* * * 7.B.S.E Profile total 535 Ranked number 1

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	535

* * * 7.B.S.E Profile total 535 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	1037
2	*	48.TETANUS	970
3		30.MERCURY	965
4		38.OXALATE	950
5		8.B.V.L.	935
6	*	41.P.P.H.	915
7		36.ORGANOC.	910
8		17.HEMLOCK	900
9	* *	43.S.MANGE	890
10	* * *	28.LICE	870

* * * 7.B.S.E Profile total 1037 Ranked number 1

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	1037

* * * 7.B.S.E Profile total 1037 Ranked number 1

B.S.E POSITIVE: Case number 4

Condition prevalence

The conditions are classified according to their relative prevalences as follows

```
* * * = Common
  * * = Encountered fairly frequently
    * = Occasionaly seen
      = Rare
```

Check list signs observed to be PRESENT

```
12. SICK 2 WEEKS OR MORE
 5. EXAGGERATED RESPONSES
10. LICKING\BITING
 6. FALLING
```

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	255
2	* * *	28.LICE	190
3	* *	43.S.MANGE	190
4		4.BRAIN T	170
5	*	48.TETANUS	155
6	* * *	19.KETOSIS	145
7	* *	40.P.MANGE	145
8	*	41.P.P.H.	145
9		50.TR.TET	145
10		15.GID	140

* * * 7.B.S.E Profile total 255 Ranked number 1

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	255

* * * 7.B.S.E Profile total 255 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1	* *	43.S.MANGE	1190
2	* *	40.P.MANGE	1145
3	*	41.P.P.H.	1075
4	* * *	28.LICE	1050
5		39.PEN ALL	1050

6		47.STRYCHN	1035
7		50.TR.TET	1025
8		14.FURIZOL	1020
9		25.LEVAMIZ	1020
10	*	21.LABERNU	1000

* * * 7.B.S.E Profile total 777 Ranked number 49

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	777

* * * 7.B.S.E Profile total 777 Ranked number 1

B.S.E POSITIVE: Case number 5

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

12. SICK 2 WEEKS OR MORE
2. APPREHENSION\NERVOUS
5. EXAGGERATED RESPONSES
9. KICKING IN PARLOUR
13. STAGGERING\DIFFICULTY WALKING
6. FALLING

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	425
2	* * *	18.HYPOMAG	305
3	* * *	33.MILK FE	270
4	*	48.TETANUS	250
5		4.BRAIN T	240
6		15.GID	220
7		17.HEMLOCK	200
8		38.OXALATE	200
9		3.BRAIN A	195
10	* *	24.LEAD AC	195

* * * 7.B.S.E Profile total 425 Ranked number 1

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	425

* * * 7.B.S.E Profile total 425 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1		14.FURIZOL	960
2	* * *	18.HYPOMAG	960
3	*	21.LABERNU	940
4	* * *	33.MILK FE	940
5	*	48.TETANUS	930
6		50.TR.TET	925
7		49.TOXOPLA	920
8	* * *	7.B.S.E	917
9		36.ORGANOC.	910
10		8.B.V.L.	895

* * * 7.B.S.E Profile total 917 Ranked number 8

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	917

* * * 7.B.S.E Profile total 917 Ranked number 1

B.S.E POSITIVE: Case number 6

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

12. SICK 2 WEEKS OR MORE
10. LICKING\BITING
9. KICKING IN PARLOUR
1. ABNORMAL HEAD\EAR POSITION
13. STAGGERING\DIFFICULTY WALKING
11. MUSCLE TREMORS
14. WEIGHT LOSS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	485
2		1.ARSENIC	275
3	* * *	18.HYPOMAG	270
4	* * *	28.LICE	270
5		30.MERCURY	245
6	* * *	33.MILK FE	240
7	*	37.OTITIS	240
8		8.B.V.L.	235
9		17.HEMLOCK	230
10	*	2.BLACK L	225

* * * 7.B.S.E Profile total 485 Ranked number 1

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	485

* * * 7.B.S.E Profile total 485 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1		1.ARSENIC	955
2	* * *	7.B.S.E	937
3		8.B.V.L.	935
4	*	2.BLACK L	925
5	*	41.P.P.H.	915
6	* * *	28.LICE	910
7	*	51.UREA	900
8	* *	43.S.MANGE	890
9		30.MERCURY	865
10		44.SALT	860

* * * 7.B.S.E Profile total 937 Ranked number 2

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	937

* * * 7.B.S.E Profile total 937 Ranked number 1

B.S.E POSITIVE: Case number 7

Condition prevalence

The conditions are classified according to their
relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

12. SICK 2 WEEKS OR MORE
2. APPREHENSION\NERVOUS
5. EXAGGERATED RESPONSES
10. LICKING\BITING
7. FRENZY
9. KICKING IN PARLOUR
1. ABNORMAL HEAD\EAR POSITION
8. HEAD PRESSING
13. STAGGERING\DIFFICULTY WALKING
11. MUSCLE TREMORS
14. WEIGHT LOSS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	696
2	* * *	18.HYPOMAG	420
3	* * *	33.MILK FE	360
4		17.HEMLOCK	340
5	* * *	28.LICE	330
6	* *	24.LEAD AC	320
7	*	48.TETANUS	320
8		4.BRAIN T	315
9		30.MERCURY	295
10		38.OXALATE	290

* * * 7.B.S.E Profile total 696 Ranked number 1

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	696

* * * 7.B.S.E Profile total 696 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	959
2	* * *	18.HYPOMAG	690
3		17.HEMLOCK	640

4	* * *	28.LICE	630
5	* * *	33.MILK FE	620
6	*	48.TETANUS	570
7		30.MERCURY	565
8		25.LEVAMIZ	560
9		1.ARSENIC	555
10		36.ORGANOC.	550

* * * 7.B.S.E Profile total 959 Ranked number 1

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	959

* * * 7.B.S.E Profile total 959 Ranked number 1

B.S.E POSITIVE: Case number 8

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

2. APPREHENSION\NERVOUS
5. EXAGGERATED RESPONSES
10. LICKING\BITING
7. FRENZY
1. ABNORMAL HEAD\EAR POSITION
13. STAGGERING\DIFFICULTY WALKING
11. MUSCLE TREMORS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	455
2	* * *	18.HYPOMAG	370
3		17.HEMLOCK	340
4	* * *	33.MILK FE	330
5	* *	24.LEAD AC	285
6		36.ORGANOC.	250
7		11.ERGOT	240
8		38.OXALATE	240
9	*	48.TETANUS	240
10	* * *	28.LICE	235

* * * 7.B.S.E Profile total 455 Ranked number 1

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	455

* * * 7.B.S.E Profile total 455 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1		17.HEMLOCK	1040
2	* * *	18.HYPOMAG	990
3	* * *	33.MILK FE	960
4		36.ORGANOC.	950
5	*	2.BLACK L	925
6		11.ERGOT	920
7	*	51.UREA	900
8	* * *	7.B.S.E	877
9	*	32.MILK AL	865
10		14.FURIZOL	860

* * * 7.B.S.E Profile total 877 Ranked number 8

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	877

* * * 7.B.S.E Profile total 877 Ranked number 1

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

12. SICK 2 WEEKS OR MORE
5. EXAGGERATED RESPONSES
10. LICKING\BITING
6. FALLING

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	255
2	* * *	28.LICE	190
3	* *	43.S.MANGE	190
4		4.BRAIN T	170
5	*	48.TETANUS	155
6	* * *	19.KETOSIS	145
7	* *	40.P.MANGE	145
8	*	41.P.P.H.	145
9		50.TR.TET	145
10		15.GID	140

* * * 7.B.S.E Profile total 255 Ranked number 1

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	255

* * * 7.B.S.E Profile total 255 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1	* *	43.S.MANGE	1190
2	* *	40.P.MANGE	1145
3	*	41.P.P.H.	1075
4	* * *	28.LICE	1050
5		39.PEN ALL	1050
6		47.STRYCHN	1035
7		50.TR.TET	1025
8		14.FURIZOL	1020
9		25.LEVAMIZ	1020
10	*	21.LABERNU	1000

* * * 7.B.S.E Profile total 777 Ranked number 49

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	777

* * * 7.B.S.E Profile total 777 Ranked number 1

B.S.E POSITIVE: Case number 10

Condition prevalence

The conditions are classified according to their relative prevalences as follows

```
* * * = Common
  * * = Encountered fairly frequently
    * = Occasionaly seen
      = Rare
```

Check list signs observed to be PRESENT

```
 2. APPREHENSION\NERVOUS
 5. EXAGGERATED RESPONSES
 7. FRENZY
 9. KICKING IN PARLOUR
 1. ABNORMAL HEAD\EAR POSITION
13. STAGGERING\DIFFICULTY WALKING
14. WEIGHT LOSS
```

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	470
2	* * *	18.HYPOMAG	350
3	* * *	33.MILK FE	280
4		17.HEMLOCK	270
5	*	48.TETANUS	260
6	* *	24.LEAD AC	245
7	* *	9.CCN	220
8		30.MERCURY	215
9		38.OXALATE	210
10		1.ARSENIC	205

```
* * *  7.B.S.E      Profile total 470   Ranked number 1
```

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	470

```
* * *  7.B.S.E      Profile total 470   Ranked number 1
```

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1	* * *	18.HYPOMAG	950
2	* * *	7.B.S.E	907
3		17.HEMLOCK	900
4		53.WATER D	885
5		14.FURIZOL	860
6	* * *	33.MILK FE	860
7		36.ORGANOC.	850
8	*	48.TETANUS	850

9	*	21.LABERNU	840
10	*	2.BLACK L	825

* * * 7.B.S.E Profile total 907 Ranked number 2

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	907

* * * 7.B.S.E Profile total 907 Ranked number 1

B.S.E POSITIVE: Case number 11

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

12. SICK 2 WEEKS OR MORE
2. APPREHENSION\NERVOUS
5. EXAGGERATED RESPONSES
10. LICKING\BITING
7. FRENZY
1. ABNORMAL HEAD\EAR POSITION
11. MUSCLE TREMORS
14. WEIGHT LOSS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	550
2	* * *	28.LICE	330
3	* * *	18.HYPOMAG	290
4		17.HEMLOCK	250
5	* * *	33.MILK FE	250
6		1.ARSENIC	225
7		30.MERCURY	225
8	*	48.TETANUS	225
9	*	37.OTITIS	220
10	*	41.P.P.H.	215

* * * 7.B.S.E Profile total 550 Ranked number 1

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	550

* * * 7.B.S.E Profile total 550 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	967
2	* * *	28.LICE	930
3	*	41.P.P.H.	815
4	* *	43.S.MANGE	790
5		17.HEMLOCK	760
6		1.ARSENIC	755
7	* *	40.P.MANGE	745
8	*	12.FAT C.S	730
9	* * *	18.HYPOMAG	730
10		36.ORGANOC.	730

* * * 7.B.S.E Profile total 967 Ranked number 1

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	967

* * * 7.B.S.E Profile total 967 Ranked number 1

B.S.E POSITIVE: Case number 12

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

12. SICK 2 WEEKS OR MORE
2. APPREHENSION\NERVOUS
5. EXAGGERATED RESPONSES
10. LICKING\BITING
7. FRENZY
9. KICKING IN PARLOUR
1. ABNORMAL HEAD\EAR POSITION
13. STAGGERING\DIFFICULTY WALKING
6. FALLING
11. MUSCLE TREMORS
14. WEIGHT LOSS

```
PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank      Condition     Sum of PPFs

1   * * *  7.B.S.E       715
2   * * * 18.HYPOMAG     450
3   * * * 33.MILK FE     400
4       * 48.TETANUS     370
5         17.HEMLOCK     340
6   * * * 28.LICE        330
7         38.OXALATE     330
8     * * 24.LEAD AC     315
9         30.MERCURY     295
10         1.ARSENIC     275

* * *  7.B.S.E       Profile total 715  Ranked number 1

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank      Condition     Sum of PPFs

1   * * *  7.B.S.E       715

* * *  7.B.S.E       Profile total 715  Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank      Condition     Sum of PPFs

1   * * *  7.B.S.E       997
2   * * * 18.HYPOMAG     750
3   * * * 33.MILK FE     700
4       * 48.TETANUS     670
5         17.HEMLOCK     640
6   * * * 28.LICE        630
7         38.OXALATE     630
8         30.MERCURY     565
9          1.ARSENIC     555
10        36.ORGANOC.    550

* * *  7.B.S.E       Profile total 997  Ranked number 1

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank      Condition      Sum of PPFs

1   * * *  7.B.S.E       997

* * *  7.B.S.E       Profile total 997  Ranked number 1
```

B.S.E POSITIVE: Case number 13

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

12. SICK 2 WEEKS OR MORE
2. APPREHENSION\NERVOUS
5. EXAGGERATED RESPONSES
10. LICKING\BITING
9. KICKING IN PARLOUR
13. STAGGERING\DIFFICULTY WALKING
11. MUSCLE TREMORS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	505
2	* * *	18.HYPOMAG	345
3	* * *	33.MILK FE	310
4		17.HEMLOCK	270
5	* *	24.LEAD AC	265
6	* * *	28.LICE	250
7	*	48.TETANUS	250
8		38.OXALATE	240
9		36.ORGANOC.	230
10		4.BRAIN T	215

* * * 7.B.S.E Profile total 505 Ranked number 1

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	505

* * * 7.B.S.E Profile total 505 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	977
2	* * *	18.HYPOMAG	940
3	* * *	33.MILK FE	920
4		36.ORGANOC.	910

5		17.HEMLOCK	900
6	* *	43.S.MANGE	890
7	* * *	28.LICE	870
8		11.ERGOT	860
9		14.FURIZOL	860
10		47.STRYCHN	855

* * * 7.B.S.E Profile total 977 Ranked number 1

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	977

* * * 7.B.S.E Profile total 977 Ranked number 1

B.S.E POSITIVE: Case number 14

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

12. SICK 2 WEEKS OR MORE
2. APPREHENSION\NERVOUS
5. EXAGGERATED RESPONSES
9. KICKING IN PARLOUR
11. MUSCLE TREMORS
14. WEIGHT LOSS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	460
2	* * *	18.HYPOMAG	265
3	* * *	33.MILK FE	230
4	*	48.TETANUS	225
5		38.OXALATE	210
6		30.MERCURY	195
7		17.HEMLOCK	180
8		4.BRAIN T	175
9	* *	24.LEAD AC	170
10		36.ORGANOC.	170

* * * 7.B.S.E Profile total 460 Ranked number 1

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	460

* * * 7.B.S.E Profile total 460 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	987
2	* * *	20.KETOSIS	955
3	*	12.FAT C.S	930
4		8.B.V.L.	895
5		13.FLUORIN	895
6		47.STRYCHN	895
7		36.ORGANOC.	890
8		38.OXALATE	890
9	* * *	18.HYPOMAG	880
10	*	48.TETANUS	880

* * * 7.B.S.E Profile total 987 Ranked number 1

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	987

* * * 7.B.S.E Profile total 987 Ranked number 1

B.S.E POSITIVE: Case number 15

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

12. SICK 2 WEEKS OR MORE
2. APPREHENSION\NERVOUS
5. EXAGGERATED RESPONSES
10. LICKING\BITING
1. ABNORMAL HEAD\EAR POSITION
14. WEIGHT LOSS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	450
2	* * *	28.LICE	330
3	*	37.OTITIS	220
4	* * *	18.HYPOMAG	215
5	*	41.P.P.H.	215
6		1.ARSENIC	205
7		30.MERCURY	205
8	* *	43.S.MANGE	190
9		17.HEMLOCK	180
10	*	48.TETANUS	175

* * * 7.B.S.E Profile total 450 Ranked number 1

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	450

* * * 7.B.S.E Profile total 450 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1	* * *	28.LICE	1130
2	*	41.P.P.H.	1015
3	* *	43.S.MANGE	990
4	* * *	7.B.S.E	967
5	* *	40.P.MANGE	945
6		1.ARSENIC	915
7		8.B.V.L.	895
8	* * *	20.KETOSIS	895
9	*	37.OTITIS	890
10		30.MERCURY	885

* * * 7.B.S.E Profile total 967 Ranked number 4

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	967

* * * 7.B.S.E Profile total 967 Ranked number 1

B.S.E POSITIVE: Case number 16

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

12. SICK 2 WEEKS OR MORE
2. APPREHENSION\NERVOUS
5. EXAGGERATED RESPONSES
10. LICKING\BITING
1. ABNORMAL HEAD\EAR POSITION
14. WEIGHT LOSS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	450
2	* * *	28.LICE	330
3	*	37.OTITIS	220
4	* * *	18.HYPOMAG	215
5	*	41.P.P.H.	215
6		1.ARSENIC	205
7		30.MERCURY	205
8	* *	43.S.MANGE	190
9		17.HEMLOCK	180
10	*	48.TETANUS	175

* * * 7.B.S.E Profile total 450 Ranked number 1

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	450

* * * 7.B.S.E Profile total 450 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1	* * *	28.LICE	1130
2	*	41.P.P.H.	1015
3	* *	43.S.MANGE	990
4	* * *	7.B.S.E	967
5	* *	40.P.MANGE	945
6		1.ARSENIC	915
7		8.B.V.L.	895
8	* * *	20.KETOSIS	895

9	* 37.OTITIS	890
10	30.MERCURY	885

* * * 7.B.S.E Profile total 967 Ranked number 4

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank	Condition	Sum of PPFs
1	* * * 7.B.S.E	967

* * * 7.B.S.E Profile total 967 Ranked number 1

B.S.E POSITIVE: Case number 17

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

12. SICK 2 WEEKS OR MORE
9. KICKING IN PARLOUR
1. ABNORMAL HEAD\EAR POSITION
8. HEAD PRESSING
13. STAGGERING\DIFFICULTY WALKING
6. FALLING
14. WEIGHT LOSS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank	Condition	Sum of PPFs
1	* * * 7.B.S.E	421
2	15.GID	310
3	4.BRAIN T	270
4	* * 9.CCN	270
5	1.ARSENIC	255
6	* 37.OTITIS	250
7	8.B.V.L.	235
8	* * * 18.HYPOMAG	230
9	* * 26.LISTERI	225
10	* 48.TETANUS	225

* * * 7.B.S.E Profile total 421 Ranked number 1

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	421

* * * 7.B.S.E Profile total 421 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1		8.B.V.L.	935
2		1.ARSENIC	915
3	* *	9.CCN	870
4	* * *	20.KETOSIS	855
5	* *	22.LAMINIT	855
6	*	37.OTITIS	850
7		15.GID	845
8	*	2.BLACK L	825
9		4.BRAIN T	815
10	* * *	7.B.S.E	809

* * * 7.B.S.E Profile total 809 Ranked number 10

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	809

* * * 7.B.S.E Profile total 809 Ranked number 1

B.S.E POSITIVE: Case number 18

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

12. SICK 2 WEEKS OR MORE
2. APPREHENSION\NERVOUS
5. EXAGGERATED RESPONSES
10. LICKING\BITING
9. KICKING IN PARLOUR
8. HEAD PRESSING
13. STAGGERING\DIFFICULTY WALKING
11. MUSCLE TREMORS
14. WEIGHT LOSS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	601
2	* * *	18.HYPOMAG	345
3	*	48.TETANUS	320
4		4.BRAIN T	315
5	* * *	33.MILK FE	310
6		30.MERCURY	295
7		38.OXALATE	290
8		17.HEMLOCK	270
9	* *	24.LEAD AC	270
10	* * *	19.KETOSIS	260

* * * 7.B.S.E Profile total 601 Ranked number 1

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	601

* * * 7.B.S.E Profile total 601 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	969
2	*	48.TETANUS	770
3		30.MERCURY	765
4		38.OXALATE	750
5	* * *	18.HYPOMAG	740
6		8.B.V.L.	735
7	* * *	33.MILK FE	720
8	*	41.P.P.H.	715
9		36.ORGANOC.	710
10		4.BRAIN T	705

* * * 7.B.S.E Profile total 969 Ranked number 1

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	969

* * * 7.B.S.E Profile total 969 Ranked number 1

B.S.E POSITIVE: Case number 19

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

12. SICK 2 WEEKS OR MORE
2. APPREHENSION\NERVOUS
5. EXAGGERATED RESPONSES
10. LICKING\BITING
9. KICKING IN PARLOUR
3. BLINDNESS
13. STAGGERING\DIFFICULTY WALKING
14. WEIGHT LOSS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	516
2		30.MERCURY	305
3		3.BRAIN A	290
4	* *	24.LEAD AC	290
5	* * *	18.HYPOMAG	275
6		4.BRAIN T	270
7	*	48.TETANUS	270
8	* *	9.CCN	265
9	* * *	19.KETOSIS	260
10		52.VIT A D	255

* * * 7.B.S.E Profile total 516 Ranked number 1

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	516

* * * 7.B.S.E Profile total 516 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	899
2		30.MERCURY	885
3		52.VIT A D	845
4		8.B.V.L.	835
5	*	41.P.P.H.	815
6		3.BRAIN A	800

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7     * * 43.S.MANGE    790
8   * * * 19.KETOSIS    775
9   * * * 28.LICE       770
10      * 48.TETANUS    770

* * *  7.B.S.E       Profile total 899  Ranked number 1
```

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

```
Rank     Condition      Sum of PPFs

1  * * *  7.B.S.E       899

* * *  7.B.S.E       Profile total 899  Ranked number 1
```

B.S.E POSITIVE: Case number 20

Condition prevalence

The conditions are classified according to their
relative prevalences as follows

```
* * * = Common
  * * = Encountered fairly frequently
    * = Occasionaly seen
      = Rare
```

Check list signs observed to be PRESENT

```
12. SICK 2 WEEKS OR MORE
 2. APPREHENSION\NERVOUS
 5. EXAGGERATED RESPONSES
10. LICKING\BITING
 9. KICKING IN PARLOUR
 1. ABNORMAL HEAD\EAR POSITION
13. STAGGERING\DIFFICULTY WALKING
 6. FALLING
11. MUSCLE TREMORS
14. WEIGHT LOSS
```

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

```
Rank      Condition   Sum of PPFs

1   * * *  7.B.S.E     685
2   * * * 18.HYPOMAG   445
3   * * * 33.MILK FE   400
4       * 48.TETANUS   370
5         17.HEMLOCK   340
6   * * * 28.LICE      330
7         38.OXALATE   330
8         30.MERCURY   295
9          1.ARSENIC   275
10         4.BRAIN T   275

* * *  7.B.S.E       Profile total 685  Ranked number 1
```

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	685

* * * 7.B.S.E Profile total 685 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	1037
2	* * *	18.HYPOMAG	840
3	* * *	33.MILK FE	800
4	*	48.TETANUS	770
5		17.HEMLOCK	740
6	* * *	28.LICE	730
7		38.OXALATE	730
8		30.MERCURY	665
9		1.ARSENIC	655
10		8.B.V.L.	635

* * * 7.B.S.E Profile total 1037 Ranked number 1

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	1037

* * * 7.B.S.E Profile total 1037 Ranked number 1

B.S.E POSITIVE: Case number 21

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

12. SICK 2 WEEKS OR MORE
2. APPREHENSION\NERVOUS
13. STAGGERING\DIFFICULTY WALKING
11. MUSCLE TREMORS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	330
2		17.HEMLOCK	230
3		3.BRAIN A	200
4	* * *	18.HYPOMAG	200
5	* * *	33.MILK FE	200
6		36.ORGANOC.	180
7		11.ERGOT	170
8		15.GID	170
9		8.B.V.L.	165
10	* *	24.LEAD AC	165

* * * 7.B.S.E Profile total 330 Ranked number 1

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	330
2		3.BRAIN A	200
3	* *	26.LISTERI	100

* * * 7.B.S.E Profile total 330 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1		35.ORGANOP.	1140
2		17.HEMLOCK	1120
3	*	6.BOTULIS	1110
4		36.ORGANOC.	1110
5	*	55.YEW	1100
6		8.B.V.L.	1095
7	* *	22.LAMINIT	1095
8	*	46.SPINE I	1095
9		54.WATER I	1090
10	*	29.MENINGI	1085

* * * 7.B.S.E Profile total 927 Ranked number 40

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1		3.BRAIN A	1020
2	* * *	7.B.S.E	927
3	* *	26.LISTERI	850

* * * 7.B.S.E Profile total 927 Ranked number 2

B.S.E POSITIVE: Case number 22

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

12. SICK 2 WEEKS OR MORE
2. APPREHENSION\NERVOUS
5. EXAGGERATED RESPONSES
10. LICKING\BITING
7. FRENZY
9. KICKING IN PARLOUR
1. ABNORMAL HEAD\EAR POSITION
8. HEAD PRESSING
13. STAGGERING\DIFFICULTY WALKING
11. MUSCLE TREMORS
14. WEIGHT LOSS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	696
2	* * *	18.HYPOMAG	420
3	* * *	33.MILK FE	360
4		17.HEMLOCK	340
5	* * *	28.LICE	330
6	* *	24.LEAD AC	320
7	*	48.TETANUS	320
8		4.BRAIN T	315
9		30.MERCURY	295
10		38.OXALATE	290

* * * 7.B.S.E Profile total 696 Ranked number 1

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	696

* * * 7.B.S.E Profile total 696 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank Condition Sum of PPFs

1	* * *	7.B.S.E	959
2	* * *	18.HYPOMAG	690
3		17.HEMLOCK	640
4	* * *	28.LICE	630
5	* * *	33.MILK FE	620
6	*	48.TETANUS	570
7		30.MERCURY	565
8		25.LEVAMIZ	560
9		1.ARSENIC	555
10		36.ORGANOC.	550

* * * 7.B.S.E Profile total 959 Ranked number 1

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	959

* * * 7.B.S.E Profile total 959 Ranked number 1

B.S.E POSITIVE: Case number 23

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

12. SICK 2 WEEKS OR MORE
2. APPREHENSION\NERVOUS
5. EXAGGERATED RESPONSES
9. KICKING IN PARLOUR
6. FALLING
13. STAGGERING\DIFFICULTY WALKING
14. WEIGHT LOSS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	505
2	*	48.TETANUS	320
3	* * *	18.HYPOMAG	305
4		4.BRAIN T	270
5	* * *	33.MILK FE	270
6		38.OXALATE	250
7		30.MERCURY	245
8		8.B.V.L.	235
9		15.GID	230

10 17.HEMLOCK 200

* * * 7.B.S.E Profile total 505 Ranked number 1

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	505

* * * 7.B.S.E Profile total 505 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	977
2	*	48.TETANUS	970
3		8.B.V.L.	935
4		38.OXALATE	870
5		30.MERCURY	865
6		14.FURIZOL	860
7	* * *	18.HYPOMAG	860
8	* * *	20.KETOSIS	855
9	* *	22.LAMINIT	855
10	*	21.LABERNU	840

* * * 7.B.S.E Profile total 977 Ranked number 1

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	977

* * * 7.B.S.E Profile total 977 Ranked number 1

B.S.E POSITIVE: Case number 24

Condition prevalence

The conditions are classified according to their
relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

12. SICK 2 WEEKS OR MORE
10. LICKING\BITING
1. ABNORMAL HEAD\EAR POSITION

6. FALLING
11. MUSCLE TREMORS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	310
2	* * *	28.LICE	270
3	*	37.OTITIS	200
4	* *	43.S.MANGE	190
5		15.GID	170
6	* * *	18.HYPOMAG	170
7	* * *	33.MILK FE	170
8	* *	40.P.MANGE	145
9	*	41.P.P.H.	145
10		17.HEMLOCK	140

* * * 7.B.S.E Profile total 310 Ranked number 1

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	310

* * * 7.B.S.E Profile total 310 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1	* * *	28.LICE	1110
2	* *	43.S.MANGE	1090
3	* *	40.P.MANGE	1045
4	*	32.MILK AL	975
5	*	41.P.P.H.	975
6	*	6.BOTULIS	970
7	*	12.FAT C.S	970
8	*	51.UREA	960
9	*	37.OTITIS	950
10		39.PEN ALL	950

* * * 7.B.S.E Profile total 787 Ranked number 35

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	787

* * * 7.B.S.E Profile total 787 Ranked number 1

B.S.E POSITIVE: Case number 25

Condition prevalence

The conditions are classified according to their relative prevalences as follows

```
* * * = Common
  * * = Encountered fairly frequently
    * = Occasionaly seen
      = Rare
```

Check list signs observed to be PRESENT

12. SICK 2 WEEKS OR MORE
2. APPREHENSION\NERVOUS
5. EXAGGERATED RESPONSES
10. LICKING\BITING
9. KICKING IN PARLOUR
11. MUSCLE TREMORS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	425
2	* * *	18.HYPOMAG	265
3	* * *	28.LICE	250
4	* * *	33.MILK FE	230
5	* *	43.S.MANGE	190
6		17.HEMLOCK	180
7	* * *	19.KETOSIS	170
8	* *	24.LEAD AC	170
9		36.ORGANOC.	170
10		38.OXALATE	160

* * * 7.B.S.E Profile total 425 Ranked number 1

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	425

* * * 7.B.S.E Profile total 425 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1	* *	43.S.MANGE	990
2	* * *	28.LICE	970
3	* *	40.P.MANGE	945

4	* * *	7.B.S.E	917
5		13.FLUORIN	895
6		47.STRYCHN	895
7		36.ORGANOC.	890
8	*	32.MILK AL	885
9	* * *	18.HYPOMAG	880
10	*	41.P.P.H.	875

* * * 7.B.S.E Profile total 917 Ranked number 4

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	917

* * * 7.B.S.E Profile total 917 Ranked number 1

B.S.E POSITIVE: Case number 26

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

12. SICK 2 WEEKS OR MORE
2. APPREHENSION\NERVOUS
5. EXAGGERATED RESPONSES
1. ABNORMAL HEAD\EAR POSITION
13. STAGGERING\DIFFICULTY WALKING
14. WEIGHT LOSS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	485
2	* * *	18.HYPOMAG	295
3		17.HEMLOCK	270
4	*	48.TETANUS	270
5		1.ARSENIC	255
6	* * *	33.MILK FE	250
7		30.MERCURY	245
8		4.BRAIN T	240
9	*	37.OTITIS	240
10		8.B.V.L.	235

* * * 7.B.S.E Profile total 485 Ranked number 1

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank	Condition	Sum of PPFs
1	* * * 7.B.S.E	485

* * * 7.B.S.E Profile total 485 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank	Condition	Sum of PPFs
1	* * * 7.B.S.E	1037
2	8.B.V.L.	1035
3	1.ARSENIC	1015
4	17.HEMLOCK	1000
5	* 48.TETANUS	970
6	30.MERCURY	965
7	14.FURIZOL	960
8	* * 22.LAMINIT	955
9	* * * 18.HYPOMAG	940
10	* 21.LABERNU	940

* * * 7.B.S.E Profile total 1037 Ranked number 1

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank	Condition	Sum of PPFs
1	* * * 7.B.S.E	1037

* * * 7.B.S.E Profile total 1037 Ranked number 1

B.S.E POSITIVE: Case number 27

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

12. SICK 2 WEEKS OR MORE
2. APPREHENSION\NERVOUS
5. EXAGGERATED RESPONSES
7. FRENZY
1. ABNORMAL HEAD\EAR POSITION
13. STAGGERING\DIFFICULTY WALKING
6. FALLING
14. WEIGHT LOSS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	550
2	* * *	18.HYPOMAG	330
3	*	48.TETANUS	320
4	* * *	33.MILK FE	290
5		4.BRAIN T	270
6		17.HEMLOCK	270
7		1.ARSENIC	255
8	*	37.OTITIS	250
9		38.OXALATE	250
10		3.BRAIN A	245

* * * 7.B.S.E Profile total 550 Ranked number 1

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	550

* * * 7.B.S.E Profile total 550 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	967
2	*	48.TETANUS	870
3		8.B.V.L.	835
4		1.ARSENIC	815
5	* * *	18.HYPOMAG	810
6		17.HEMLOCK	800
7		53.WATER D	785
8	* * *	33.MILK FE	780
9		38.OXALATE	770
10		30.MERCURY	765

* * * 7.B.S.E Profile total 967 Ranked number 1

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	967

* * * 7.B.S.E Profile total 967 Ranked number 1

B.S.E POSITIVE: Case number 28

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

2. APPREHENSION\NERVOUS
5. EXAGGERATED RESPONSES
9. KICKING IN PARLOUR
13. STAGGERING\DIFFICULTY WALKING

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	295
2	* * *	18.HYPOMAG	275
3	* * *	33.MILK FE	230
4		17.HEMLOCK	200
5	* *	24.LEAD AC	195
6	*	48.TETANUS	190
7		36.ORGANOC.	180
8		14.FURIZOL	160
9		38.OXALATE	160
10		11.ERGOT	150

* * * 7.B.S.E Profile total 295 Ranked number 1

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	295
2	* * *	18.HYPOMAG	275
3	* * *	33.MILK FE	230

* * * 7.B.S.E Profile total 295 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1		14.FURIZOL	1160
2	*	21.LABERNU	1140
3		49.TOXOPLA	1120
4		36.ORGANOC.	1110
5	* * *	18.HYPOMAG	1100

6	*	46.SPINE I	1095
7		47.STRYCHN	1095
8		17.HEMLOCK	1060
9	* * *	33.MILK FE	1060
10	*	27.LOUPING	1050

* * * 7.B.S.E Profile total 857 Ranked number 42

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	18.HYPOMAG	1100
2	* * *	33.MILK FE	1060
3	* * *	7.B.S.E	857

* * * 7.B.S.E Profile total 857 Ranked number 3

B.S.E POSITIVE: Case number 29

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

12. SICK 2 WEEKS OR MORE
2. APPREHENSION\NERVOUS
5. EXAGGERATED RESPONSES
7. FRENZY
1. ABNORMAL HEAD\EAR POSITION
13. STAGGERING\DIFFICULTY WALKING
11. MUSCLE TREMORS
14. WEIGHT LOSS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	585
2	* * *	18.HYPOMAG	370
3		17.HEMLOCK	340
4	* * *	33.MILK FE	330
5	*	48.TETANUS	320
6		38.OXALATE	290
7	* *	24.LEAD AC	285
8		1.ARSENIC	275
9		30.MERCURY	265
10		3.BRAIN A	250

* * * 7.B.S.E Profile total 585 Ranked number 1

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank	Condition	Sum of PPFs
1 * * *	7.B.S.E	585

* * * 7.B.S.E Profile total 585 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank	Condition	Sum of PPFs
1 * * *	7.B.S.E	1037
2	17.HEMLOCK	940
3 * * *	18.HYPOMAG	890
4 *	48.TETANUS	870
5 * * *	33.MILK FE	860
6	1.ARSENIC	855
7	36.ORGANOC.	850
8	38.OXALATE	850
9	8.B.V.L.	835
10 *	2.BLACK L	825

* * * 7.B.S.E Profile total 1037 Ranked number 1

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank	Condition	Sum of PPFs
1 * * *	7.B.S.E	1037

* * * 7.B.S.E Profile total 1037 Ranked number 1

B.S.E POSITIVE: Case number 30

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * - Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

2. APPREHENSION\NERVOUS
5. EXAGGERATED RESPONSES
11. MUSCLE TREMORS
14. WEIGHT LOSS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	315
2	* * *	18.HYPOMAG	215
3	*	48.TETANUS	215
4		38.OXALATE	210
5	* * *	33.MILK FE	200
6		17.HEMLOCK	180
7		36.ORGANOC.	170
8		30.MERCURY	165
9		11.ERGOT	150
10	* *	24.LEAD AC	140

* * * 7.B.S.E Profile total 315 Ranked number 1

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	315

* * * 7.B.S.E Profile total 315 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1		13.FLUORIN	1095
2		47.STRYCHN	1095
3		36.ORGANOC.	1090
4		38.OXALATE	1090
5	*	12.FAT C.S	1070
6	*	6.BOTULIS	1060
7		44.SALT	1060
8	*	48.TETANUS	1060
9	*	27.LOUPING	1050
10		11.ERGOT	1040

* * * 7.B.S.E Profile total 897 Ranked number 41

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	897

* * * 7.B.S.E Profile total 897 Ranked number 1

B.S.E POSITIVE: Case number 31

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

12. SICK 2 WEEKS OR MORE
2. APPREHENSION\NERVOUS
5. EXAGGERATED RESPONSES
10. LICKING\BITING
1. ABNORMAL HEAD\EAR POSITION
13. STAGGERING\DIFFICULTY WALKING
11. MUSCLE TREMORS
14. WEIGHT LOSS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	600
2	* * *	18.HYPOMAG	365
3		17.HEMLOCK	340
4	* * *	28.LICE	330
5	* * *	33.MILK FE	330
6	*	48.TETANUS	320
7		30.MERCURY	295
8		38.OXALATE	290
9		1.ARSENIC	275
10		4.BRAIN T	245

* * * 7.B.S.E Profile total 600 Ranked number 1

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	600

* * * 7.B.S.E Profile total 600 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	1067
2		17.HEMLOCK	940
3	* * *	28.LICE	930
4	* * *	18.HYPOMAG	880
5	*	48.TETANUS	870

```
6          30.MERCURY    865
7   * * *  33.MILK FE    860
8           1.ARSENIC    855
9          38.OXALATE    850
10          8.B.V.L.     835
```

```
* * *  7.B.S.E       Profile total 1067  Ranked number 1
```

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

```
Rank     Condition      Sum of PPFs

1  * * *  7.B.S.E      1067
```

```
* * *  7.B.S.E       Profile total 1067  Ranked number 1
```

B.S.E POSITIVE: Case number 32

Condition prevalence

The conditions are classified according to their relative prevalences as follows

```
* * * = Common
  * * = Encountered fairly frequently
    * = Occasionaly seen
      = Rare
```

Check list signs observed to be PRESENT

12. SICK 2 WEEKS OR MORE
2. APPREHENSION\NERVOUS
5. EXAGGERATED RESPONSES
10. LICKING\BITING
9. KICKING IN PARLOUR
1. ABNORMAL HEAD\EAR POSITION
13. STAGGERING\DIFFICULTY WALKING
11. MUSCLE TREMORS
14. WEIGHT LOSS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

```
Rank     Condition    Sum of PPFs

1   * * *  7.B.S.E      650
2   * * * 18.HYPOMAG    415
3   * * * 33.MILK FE    360
4         17.HEMLOCK    340
5   * * * 28.LICE       330
6       * 48.TETANUS    320
7         30.MERCURY    295
8         38.OXALATE    290
9          1.ARSENIC    275
10    * * 24.LEAD AC    265
```

```
* * *  7.B.S.E       Profile total 650  Ranked number 1
```

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	650

* * * 7.B.S.E Profile total 650 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	1067
2	* * *	18.HYPOMAG	880
3		17.HEMLOCK	840
4	* * *	28.LICE	830
5	* * *	33.MILK FE	820
6	*	48.TETANUS	770
7		30.MERCURY	765
8		1.ARSENIC	755
9		38.OXALATE	750
10		8.B.V.L.	735

* * * 7.B.S.E Profile total 1067 Ranked number 1

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	1067

* * * 7.B.S.E Profile total 1067 Ranked number 1

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

5. EXAGGERATED RESPONSES
9. KICKING IN PARLOUR

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

```
Rank        Condition   Sum of PPFs

1   * * * 18.HYPOMAG    145
2   * * *  7.B.S.E      130
3   * * * 33.MILK FE    110
4   * * * 19.KETOSIS    100
5     * * 24.LEAD AC    100
6         47.STRYCHN    95
7       * 48.TETANUS    95
8         50.TR.TET     95
9         14.FURIZOL    90
10        25.LEVAMIZ    80

* * *  7.B.S.E      Profile total 130  Ranked number 2
```

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

```
Rank        Condition   Sum of PPFs

1   * * * 18.HYPOMAG    145
2   * * *  7.B.S.E      130
3   * * * 33.MILK FE    110
4   * * * 19.KETOSIS    100
5     * * 24.LEAD AC    100
6     * * 23.LEAD CH    45

* * *  7.B.S.E      Profile total 130  Ranked number 2
```

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

```
Rank        Condition   Sum of PPFs

1         47.STRYCHN    1235
2         14.FURIZOL    1220
3       * 21.LABERNU    1200
4         13.FLUORIN    1195
5         49.TOXOPLA    1180
6       * 27.LOUPING    1150
7         39.PEN ALL    1150
8     * * 34.OES.OBS    1130
9         50.TR.TET     1125
10        10.CYANIDE    1120

* * *  7.B.S.E      Profile total 727  Ranked number 54
```

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

```
Rank        Condition     Sum of PPFs

1   * * * 19.KETOSIS    1055
2     * * 23.LEAD CH    1050
3   * * * 18.HYPOMAG    1040
4   * * * 33.MILK FE    1020
5     * * 24.LEAD AC    985
6   * * *  7.B.S.E      727
```

* * * 7.B.S.E Profile total 727 Ranked number 6

B.S.E POSITIVE: Case number 24

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

12. SICK 2 WEEKS OR MORE
2. APPREHENSION\NERVOUS
5. EXAGGERATED RESPONSES
10. LICKING\BITING
11. MUSCLE TREMORS
14. WEIGHT LOSS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	455
2	* * *	28.LICE	250
3		30.MERCURY	225
4	*	48.TETANUS	225
5	* * *	18.HYPOMAG	215
6	*	41.P.P.H.	215
7		38.OXALATE	210
8	* * *	33.MILK FE	200
9	* *	43.S.MANGE	190
10		17.HEMLOCK	180

* * * 7.B.S.E Profile total 455 Ranked number 1

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	455

* * * 7.B.S.E Profile total 455 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1	*	41.P.P.H.	1015

2	* *	43.S.MANGE	990
3	* * *	7.B.S.E	977
4	* * *	28.LICE	970
5	* *	40.P.MANGE	945
6	*	12.FAT C.S	930
7		30.MERCURY	925
8		8.B.V.L.	895
9		13.FLUORIN	895
10	* * *	20.KETOSIS	895

* * * 7.B.S.E Profile total 977 Ranked number 3

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	977

* * * 7.B.S.E Profile total 977 Ranked number 1

B.S.E POSITIVE: Case number 35

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

12. SICK 2 WEEKS OR MORE
2. APPREHENSION\NERVOUS
5. EXAGGERATED RESPONSES
10. LICKING\BITING
9. KICKING IN PARLOUR
13. STAGGERING\DIFFICULTY WALKING
11. MUSCLE TREMORS
14. WEIGHT LOSS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	585
2	* * *	18.HYPOMAG	345
3	*	48.TETANUS	320
4	* * *	33.MILK FE	310
5		30.MERCURY	295
6		38.OXALATE	290
7		17.HEMLOCK	270
8	* *	24.LEAD AC	265
9	* * *	28.LICE	250
10		4.BRAIN T	245

* * * 7.B.S.E Profile total 585 Ranked number 1

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	585

* * * 7.B.S.E Profile total 585 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	1037
2	*	48.TETANUS	870
3		30.MERCURY	865
4		38.OXALATE	850
5	* * *	18.HYPOMAG	840
6		8.B.V.L.	835
7	* * *	33.MILK FE	820
8	*	41.P.P.H.	815
9		36.ORGANOC.	810
10		17.HEMLOCK	800

* * * 7.B.S.E Profile total 1037 Ranked number 1

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	1037

* * * 7.B.S.E Profile total 1037 Ranked number 1

B.S.E POSITIVE: Case number 36

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

12. SICK 2 WEEKS OR MORE
2. APPREHENSION\NERVOUS
5. EXAGGERATED RESPONSES
13. STAGGERING\DIFFICULTY WALKING

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	340
2	* * *	18.HYPOMAG	225
3		4.BRAIN T	210
4		17.HEMLOCK	200
5	* * *	33.MILK FE	200
6	*	48.TETANUS	200
7		3.BRAIN A	195
8		36.ORGANOC.	180
9		8.B.V.L.	165
10	* *	24.LEAD AC	165

* * * 7.B.S.E Profile total 340 Ranked number 1

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	340

* * * 7.B.S.E Profile total 340 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1		14.FURIZOL	1160
2	*	21.LABERNU	1140
3		49.TOXOPLA	1120
4		36.ORGANOC.	1110
5		8.B.V.L.	1095
6	* *	22.LAMINIT	1095
7	*	46.SPINE I	1095
8		47.STRYCHN	1095
9		17.HEMLOCK	1060
10	*	27.LOUPING	1050

* * * 7.B.S.E Profile total 947 Ranked number 33

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	947

* * * 7.B.S.E Profile total 947 Ranked number 1

B.S.E POSITIVE: Case number 37

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

12. SICK 2 WEEKS OR MORE
5. EXAGGERATED RESPONSES
9. KICKING IN PARLOUR
13. STAGGERING\DIFFICULTY WALKING
14. WEIGHT LOSS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	385
2	*	48.TETANUS	270
3		30.MERCURY	245
4		4.BRAIN T	240
5		8.B.V.L.	235
6	* * *	18.HYPOMAG	225
7		38.OXALATE	210
8		1.ARSENIC	195
9	* *	24.LEAD AC	195
10	* * *	33.MILK FE	190

* * * 7.B.S.E Profile total 385 Ranked number 1

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	385

* * * 7.B.S.E Profile total 385 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1		8.B.V.L.	1135
2	*	48.TETANUS	1070
3		30.MERCURY	1065
4		14.FURIZOL	1060
5	* * *	20.KETOSIS	1055
6	* *	22.LAMINIT	1055

7	*	21.LABERNU	1040
8		49.TOXOPLA	1020
9		52.VIT A D	1005
10		1.ARSENIC	995

* * * 7.B.S.E Profile total 937 Ranked number 21

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	937

* * * 7.B.S.E Profile total 937 Ranked number 1

B.S.E POSITIVE: Case number 38

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

12. SICK 2 WEEKS OR MORE
10. LICKING\BITING
1. ABNORMAL HEAD\EAR POSITION
13. STAGGERING\DIFFICULTY WALKING
11. MUSCLE TREMORS
14. WEIGHT LOSS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	435
2		1.ARSENIC	275
3	* * *	28.LICE	270
4		30.MERCURY	245
5	*	37.OTITIS	240
6		8.B.V.L.	235
7		17.HEMLOCK	230
8	*	2.BLACK L	225
9	*	48.TETANUS	225
10	* *	9.CCN	220

* * * 7.B.S.E Profile total 435 Ranked number 1

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank Condition Sum of PPFs

1 * * * 7.B.S.E 435

* * * 7.B.S.E Profile total 435 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1		1.ARSENIC	1055
2		8.B.V.L.	1035
3	*	2.BLACK L	1025
4	*	41.P.P.H.	1015
5	* * *	28.LICE	1010
6	*	51.UREA	1000
7	* *	43.S.MANGE	990
8		30.MERCURY	965
9		44.SALT	960
10	* *	22.LAMINIT	955

* * * 7.B.S.E Profile total 937 Ranked number 13

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank Condition Sum of PPFs

1 * * * 7.B.S.E 937

* * * 7.B.S.E Profile total 937 Ranked number 1

B.S.E POSITIVE: Case number 39

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

12. SICK 2 WEEKS OR MORE
2. APPREHENSION\NERVOUS
10. LICKING\BITING
13. STAGGERING\DIFFICULTY WALKING
6. FALLING
11. MUSCLE TREMORS
14. WEIGHT LOSS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	490
2	*	48.TETANUS	275
3		15.GID	250
4	* * *	28.LICE	250
5		38.OXALATE	250
6		30.MERCURY	245
7	* * *	33.MILK FE	240
8		8.B.V.L.	235
9	*	5.B.M.C.	230
10		17.HEMLOCK	230

* * * 7.B.S.E Profile total 490 Ranked number 1

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	490

* * * 7.B.S.E Profile total 490 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	947
2		8.B.V.L.	935
3	*	41.P.P.H.	915
4	*	5.B.M.C.	905
5	* *	43.S.MANGE	890
6		44.SALT	880
7	*	48.TETANUS	880
8	* * *	28.LICE	870
9		38.OXALATE	870
10		30.MERCURY	865

* * * 7.B.S.E Profile total 947 Ranked number 1

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	947

* * * 7.B.S.E Profile total 947 Ranked number 1

B.S.E POSITIVE: Case number 40

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

12. SICK 2 WEEKS OR MORE
2. APPREHENSION\NERVOUS
5. EXAGGERATED RESPONSES
10. LICKING\BITING
7. FRENZY
1. ABNORMAL HEAD\EAR POSITION
13. STAGGERING\DIFFICULTY WALKING
6. FALLING
11. MUSCLE TREMORS
14. WEIGHT LOSS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	665
2	* * *	18.HYPOMAG	400
3	* * *	33.MILK FE	370
4	*	48.TETANUS	370
5		17.HEMLOCK	340
6	* * *	28.LICE	330
7		38.OXALATE	330
8		30.MERCURY	295
9	* *	24.LEAD AC	285
10		1.ARSENIC	275

* * * 7.B.S.E Profile total 665 Ranked number 1

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	665

* * * 7.B.S.E Profile total 665 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	997
2	*	48.TETANUS	770
3	* * *	18.HYPOMAG	750
4		17.HEMLOCK	740
5	* * *	33.MILK FE	740

6	* * *	28.LICE	730
7		38.OXALATE	730
8		30.MERCURY	665
9		1.ARSENIC	655
10		36.ORGANOC.	650

* * * 7.B.S.E Profile total 997 Ranked number 1

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	997

* * * 7.B.S.E Profile total 997 Ranked number 1

B.S.E POSITIVE: Case number 41

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

12. SICK 2 WEEKS OR MORE
2. APPREHENSION\NERVOUS
5. EXAGGERATED RESPONSES
10. LICKING\BITING
9. KICKING IN PARLOUR
13. STAGGERING\DIFFICULTY WALKING
11. MUSCLE TREMORS
14. WEIGHT LOSS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	585
2	* * *	18.HYPOMAG	345
3	*	48.TETANUS	320
4	* * *	33.MILK FE	310
5		30.MERCURY	295
6		38.OXALATE	290
7		17.HEMLOCK	270
8	* *	24.LEAD AC	265
9	* * *	28.LICE	250
10		4.BRAIN T	245

* * * 7.B.S.E Profile total 585 Ranked number 1

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	585

* * * 7.B.S.E Profile total 585 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	1037
2	*	48.TETANUS	870
3		30.MERCURY	865
4		38.OXALATE	850
5	* * *	18.HYPOMAG	840
6		8.B.V.L.	835
7	* * *	33.MILK FE	820
8	*	41.P.P.H.	815
9		36.ORGANOC.	810
10		17.HEMLOCK	800

* * * 7.B.S.E Profile total 1037 Ranked number 1

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	1037

* * * 7.B.S.E Profile total 1037 Ranked number 1

B.S.E POSITIVE: Case number 42

Condition prevalence

The conditions are classified according to their
relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

12. SICK 2 WEEKS OR MORE
5. EXAGGERATED RESPONSES
14. WEIGHT LOSS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	255
2		30.MERCURY	175
3	*	48.TETANUS	175
4		4.BRAIN T	170
5		8.B.V.L.	165
6		1.ARSENIC	145
7		52.VIT A D	135
8		38.OXALATE	130
9	* * *	20.KETOSIS	125
10	*	37.OTITIS	125

* * * 7.B.S.E Profile total 255 Ranked number 1

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	255
2		30.MERCURY	175
3	*	48.TETANUS	175
4		4.BRAIN T	170
5		52.VIT A D	135
6	*	29.MENINGI	40

* * * 7.B.S.E Profile total 255 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1		8.B.V.L.	1195
2	* * *	20.KETOSIS	1195
3	* *	40.P.MANGE	1145
4		47.STRYCHN	1135
5		30.MERCURY	1125
6	*	41.P.P.H.	1125
7		14.FURIZOL	1120
8		52.VIT A D	1105
9	*	21.LABERNU	1100
10	* *	43.S.MANGE	1100

* * * 7.B.S.E Profile total 877 Ranked number 48

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1		30.MERCURY	1125
2		52.VIT A D	1105
3	*	48.TETANUS	1080
4		4.BRAIN T	1015
5	*	29.MENINGI	965

6 * * * 7.B.S.E 877

* * * 7.B.S.E Profile total 877 Ranked number 6

B.S.E POSITIVE: Case number 43

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

12. SICK 2 WEEKS OR MORE
2. APPREHENSION\NERVOUS
5. EXAGGERATED RESPONSES
10. LICKING\BITING
7. FRENZY
9. KICKING IN PARLOUR
1. ABNORMAL HEAD\EAR POSITION
13. STAGGERING\DIFFICULTY WALKING
11. MUSCLE TREMORS
14. WEIGHT LOSS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	680
2	* * *	18.HYPOMAG	420
3	* * *	33.MILK FE	360
4		17.HEMLOCK	340
5	* * *	28.LICE	330
6	*	48.TETANUS	320
7	* *	24.LEAD AC	315
8		30.MERCURY	295
9		38.OXALATE	290
10		1.ARSENIC	275

* * * 7.B.S.E Profile total 680 Ranked number 1

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	680

* * * 7.B.S.E Profile total 680 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	1027
2	* * *	18.HYPOMAG	790
3		17.HEMLOCK	740
4	* * *	28.LICE	730
5	* * *	33.MILK FE	720
6	*	48.TETANUS	670
7		30.MERCURY	665
8		1.ARSENIC	655
9		36.ORGANOC.	650
10		38.OXALATE	650

* * * 7.B.S.E Profile total 1027 Ranked number 1

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	1027

* * * 7.B.S.E Profile total 1027 Ranked number 1

B.S.E POSITIVE: Case number 44

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

12. SICK 2 WEEKS OR MORE
2. APPREHENSION\NERVOUS
5. EXAGGERATED RESPONSES
10. LICKING\BITING
9. KICKING IN PARLOUR
13. STAGGERING\DIFFICULTY WALKING
11. MUSCLE TREMORS
14. WEIGHT LOSS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	585
2	* * *	18.HYPOMAG	345
3	*	48.TETANUS	320
4	* * *	33.MILK FE	310
5		30.MERCURY	295

6		38.OXALATE	290
7		17.HEMLOCK	270
8	* *	24.LEAD AC	265
9	* * *	28.LICE	250
10		4.BRAIN T	245

* * * 7.B.S.E Profile total 585 Ranked number 1

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	585

* * * 7.B.S.E Profile total 585 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	1037
2	*	48.TETANUS	870
3		30.MERCURY	865
4		38.OXALATE	850
5	* * *	18.HYPOMAG	840
6		8.B.V.L.	835
7	* * *	33.MILK FE	820
8	*	41.P.P.H.	815
9		36.ORGANOC.	810
10		17.HEMLOCK	800

* * * 7.B.S.E Profile total 1037 Ranked number 1

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	1037

* * * 7.B.S.E Profile total 1037 Ranked number 1

B.S.E POSITIVE: Case number 45

Condition prevalence

The conditions are classified according to their
relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

10. LICKING\BITING
6. FALLING

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	28.LICE	95
2	*	41.P.P.H.	95
3	* *	43.S.MANGE	95
4	* * *	7.B.S.E	80
5	* * *	19.KETOSIS	75
6		15.GID	70
7	*	32.MILK AL	70
8		25.LEVAMIZ	60
9	*	5.B.M.C.	50
10		39.PEN ALL	50

* * * 7.B.S.E Profile total 80 Ranked number 4

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	80
2	* * *	19.KETOSIS	75

* * * 7.B.S.E Profile total 80 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1		39.PEN ALL	1250
2	* *	43.S.MANGE	1200
3	*	32.MILK AL	1175
4	*	41.P.P.H.	1175
5	* *	40.P.MANGE	1155
6	* *	34.OES.OBS	1130
7		54.WATER I	1110
8	*	46.SPINE I	1105
9	*	55.YEW	1100
10		13.FLUORIN	1095

* * * 7.B.S.E Profile total 627 Ranked number 55

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	19.KETOSIS	1005

2 * * * 7.B.S.E 627

* * * 7.B.S.E Profile total 627 Ranked number 2

B.S.E POSITIVE: Case number 46

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

2. APPREHENSION\NERVOUS
5. EXAGGERATED RESPONSES
7. FRENZY
9. KICKING IN PARLOUR
1. ABNORMAL HEAD\EAR POSITION
13. STAGGERING\DIFFICULTY WALKING
11. MUSCLE TREMORS
14. WEIGHT LOSS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	540
2	* * *	18.HYPOMAG	420
3	* * *	33.MILK FE	360
4		17.HEMLOCK	340
5	* *	24.LEAD AC	315
6	*	48.TETANUS	310
7		38.OXALATE	290
8		36.ORGANOC.	250
9		11.ERGOT	240
10		30.MERCURY	235

* * * 7.B.S.E Profile total 540 Ranked number 1

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	540

* * * 7.B.S.E Profile total 540 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1	* * *	18.HYPOMAG	990
2	* * *	7.B.S.E	947
3		17.HEMLOCK	940
4	* * *	33.MILK FE	920
5		36.ORGANOC.	850
6		38.OXALATE	850
7	*	48.TETANUS	850
8	*	2.BLACK L	825
9		11.ERGOT	820
10	* *	24.LEAD AC	815

* * * 7.B.S.E Profile total 947 Ranked number 2

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	947

* * * 7.B.S.E Profile total 947 Ranked number 1

B.S.E POSITIVE: Case number 47

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

12. SICK 2 WEEKS OR MORE
2. APPREHENSION\NERVOUS
5. EXAGGERATED RESPONSES
10. LICKING\BITING
13. STAGGERING\DIFFICULTY WALKING
6. FALLING
14. WEIGHT LOSS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	500
2	*	48.TETANUS	320
3		30.MERCURY	275
4		4.BRAIN T	270
5	* * *	18.HYPOMAG	255
6	* * *	28.LICE	250
7		38.OXALATE	250
8	* * *	33.MILK FE	240

9	8.B.V.L.	235
10	15.GID	230

* * * 7.B.S.E Profile total 500 Ranked number 1

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank	Condition	Sum of PPFs
1	* * * 7.B.S.E	500

* * * 7.B.S.E Profile total 500 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank	Condition	Sum of PPFs
1	* 48.TETANUS	970
2	* * * 7.B.S.E	967
3	8.B.V.L.	935
4	30.MERCURY	925
5	* 41.P.P.H.	915
6	* * 43.S.MANGE	890
7	* * * 28.LICE	870
8	38.OXALATE	870
9	14.FURIZOL	860
10	* * 22.LAMINIT	855

* * * 7.B.S.E Profile total 967 Ranked number 2

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank	Condition	Sum of PPFs
1	* * * 7.B.S.E	967

* * * 7.B.S.E Profile total 967 Ranked number 1

B.S.E POSITIVE: Case number 48

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

12. SICK 2 WEEKS OR MORE
2. APPREHENSION\NERVOUS

5. EXAGGERATED RESPONSES
10. LICKING\BITING
9. KICKING IN PARLOUR
13. STAGGERING\DIFFICULTY WALKING
11. MUSCLE TREMORS
14. WEIGHT LOSS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	585
2	* * *	18.HYPOMAG	345
3	*	48.TETANUS	320
4	* * *	33.MILK FE	310
5		30.MERCURY	295
6		38.OXALATE	290
7		17.HEMLOCK	270
8	* *	24.LEAD AC	265
9	* * *	28.LICE	250
10		4.BRAIN T	245

* * * 7.B.S.E Profile total 585 Ranked number 1

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	585

* * * 7.B.S.E Profile total 585 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	1037
2	*	48.TETANUS	870
3		30.MERCURY	865
4		38.OXALATE	850
5	* * *	18.HYPOMAG	840
6		8.B.V.L.	835
7	* * *	33.MILK FE	820
8	*	41.P.P.H.	815
9		36.ORGANOC.	810
10		17.HEMLOCK	800

* * * 7.B.S.E Profile total 1037 Ranked number 1

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank Condition Sum of PPFs

1 * * * 7.B.S.E 1037

* * * 7.B.S.E Profile total 1037 Ranked number 1

B.S.E POSITIVE: Case number 49

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

12. SICK 2 WEEKS OR MORE
2. APPREHENSION\NERVOUS
5. EXAGGERATED RESPONSES
10. LICKING\BITING
1. ABNORMAL HEAD\EAR POSITION
13. STAGGERING\DIFFICULTY WALKING
11. MUSCLE TREMORS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	520
2	* * *	18.HYPOMAG	365
3		17.HEMLOCK	340
4	* * *	28.LICE	330
5	* * *	33.MILK FE	330
6	*	48.TETANUS	250
7		38.OXALATE	240
8	* *	24.LEAD AC	235
9		36.ORGANOC.	230
10	*	2.BLACK L	225

* * * 7.B.S.E Profile total 520 Ranked number 1

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	520

* * * 7.B.S.E Profile total 520 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank		Condition	Sum of PPFs
1		17.HEMLOCK	1040
2	* * *	28.LICE	1030
3	* * *	7.B.S.E	1007
4	* * *	18.HYPOMAG	980
5	* * *	33.MILK FE	960
6	*	2.BLACK L	925
7		36.ORGANOC.	910
8	*	51.UREA	900
9	* *	43.S.MANGE	890
10		11.ERGOT	860

* * * 7.B.S.E Profile total 1007 Ranked number 3

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	1007

* * * 7.B.S.E Profile total 1007 Ranked number 1

B.S.E POSITIVE: Case number 50

Condition prevalence

The conditions are classified according to their relative prevalences as follows

* * * = Common
* * = Encountered fairly frequently
* = Occasionaly seen
= Rare

Check list signs observed to be PRESENT

12. SICK 2 WEEKS OR MORE
2. APPREHENSION\NERVOUS
10. LICKING\BITING
14. WEIGHT LOSS

PATTERN MATCHING MODEL 1

Sum of PPFs of signs present

Rank		Condition	Sum of PPFs
1	* * *	7.B.S.E	305
2	* * *	28.LICE	250
3	*	41.P.P.H.	215
4	* *	43.S.MANGE	190
5		8.B.V.L.	165
6		30.MERCURY	155
7		1.ARSENIC	145
8		3.BRAIN A	145
9	* *	40.P.MANGE	145
10	* * *	20.KETOSIS	125

* * * 7.B.S.E Profile total 305 Ranked number 1

PATTERN MATCHING: MODEL 2

Sum of PPFs of signs present with logical exclusion

Rank	Condition	Sum of PPFs
1	* * * 7.B.S.E	305

* * * 7.B.S.E Profile total 305 Ranked number 1

PATTERN MATCHING MODEL 3

Sum of PPFs of signs present and signs absent

Rank	Condition	Sum of PPFs
1	* 41.P.P.H.	1215
2	* * 43.S.MANGE	1190
3	* * * 28.LICE	1170
4	* * 40.P.MANGE	1145
5	8.B.V.L.	1095
6	* * * 20.KETOSIS	1095
7	39.PEN ALL	1050
8	1.ARSENIC	995
9	* 12.FAT C.S	990
10	30.MERCURY	985

* * * 7.B.S.E Profile total 877 Ranked number 30

PATTERN MATCHING MODEL 4

Sum of PPFs of signs present and absent with logical exclusion

Rank	Condition	Sum of PPFs
1	* * * 7.B.S.E	877

* * * 7.B.S.E Profile total 877 Ranked number 1

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